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Index to Advertisers and Classified Index Following Reading Matter.

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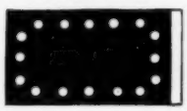

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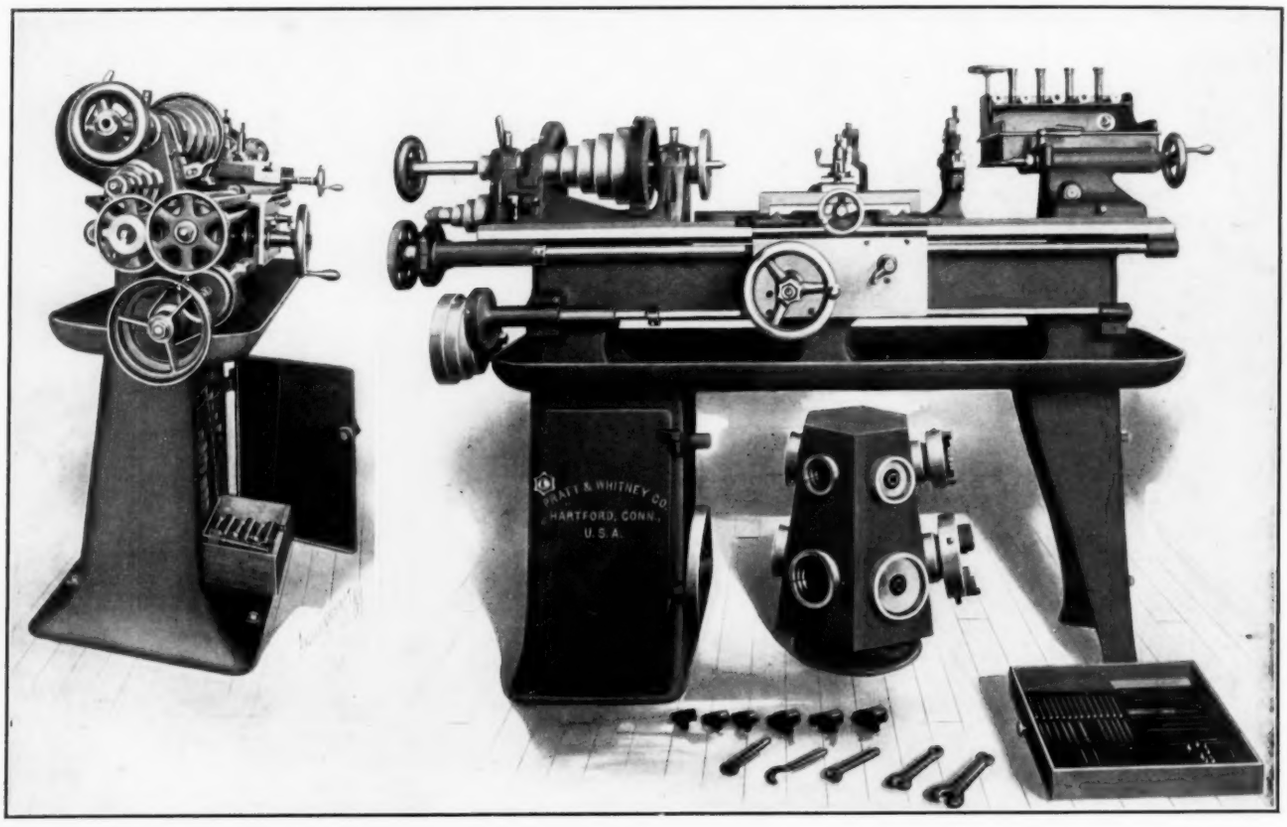
AGENTS: Manning, Maxwell & Moore, New York, Chicago, Cleveland, Pittsburgh, Boston. Chas. Churchill & Co., London, Birmingham, Glasgow, Manchester, Newcastle-on-Tyne. Selig, Sonnenthal & Co., London. Fenwick Freres & Co., Paris.

Springfield, Mass.



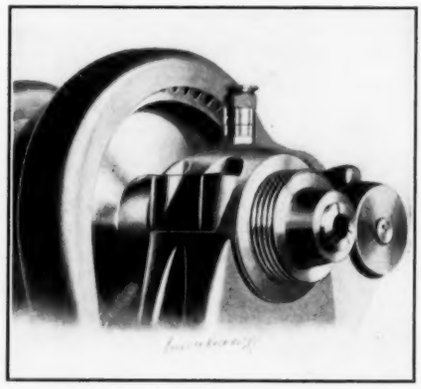
A 10-inch Tool Makers' Lathe of New Design

This is a lathe for tool room use embodying many new and valuable features, some few of which are :

The head spindle, which has a front bearing $1\frac{1}{16}$ inches in diameter and 3 inches long, is made of a selected crucible steel. It is ground and runs in carefully alined and hand fitted cylindrical bearings of babbitt metal, cast solid into the head and cap, instead of into boxes, so that there are no extra joints to work loose and to cause chattering. There is a $\frac{13}{16}$ inch hole through the head spindle, and provided with the usual hardened and ground draw-back collets, the largest taking $\frac{5}{8}$ inch stock. Collets of the step chuck type are also furnished, and thus it is possible to hold short pieces of larger diameter than the spindle capacity.

The spindle nose is somewhat different from the usual design. The end of the nose is taper and is hardened and ground ; the face-plate, chuck or other fixture being drawn up tight on the taper. The usual collar or flange at the back of the thread being done away with, the overhang of the spindle is reduced and the work is held nearer the front bearing.

The driving cone which takes a belt $1\frac{1}{2}$ inches wide, has five steps, the largest being $7\frac{1}{8}$ inches and the smallest $2\frac{7}{8}$ inches in diameter. With a countershaft speed of 150 turns per minute, the spindle speeds range from 8.4 to 384.8 turns per minute. The back gears give ample power for quite heavy work, the ratio of gearing being 7.8 to 1.



SPINDLE NOSE

The cross feed screw—which has an adjustable micrometer dial reading to 0.0005 inch—is journaled in the swivel and fits a nut held in the taper bar connecting strap, so that adjustment of the cutting tool is always possible. Both screw and rod longitudinal feeds are provided. The rod feed has a three grade cone and is arranged with an adjustable knock-off which will be appreciated by the workmen. The maximum and minimum rod feeds are 0.0152 and 0.0066 inch per turn of spindle. The rack and pinion are cut from steel and the worm runs in oil.

The lead screw is quite large and so located as to be protected from chips and dirt.

Not all of the appliances shown in the half-tones regularly accompany the lathe, some being furnished only to order. In the regular equipment are included—in addition to the attachments usually furnished with lathes—nine draw-back collets taking round stock from $\frac{1}{8}$ to $\frac{5}{8}$ inch in diameter.

The lathe is fitted with either English or metric lead screw. With the English screw it will cut from $1\frac{1}{2}$ to 156 threads per inch ; or metric threads from 13 to .25 m/m pitch. With the metric screw it will cut threads from 20 to 50 m/m pitch ; or from $1\frac{1}{2}$ to 39 threads per inch.

The lathe swings $10\frac{3}{4}$ inches over the bed and $4\frac{13}{16}$ inches over the carriage ; the bed is 5 feet long, and the greatest distance between centers is 29 inches. The countershaft pulleys are 8 inches in diameter by $2\frac{3}{4}$ inches face. The total weight of lathe with attachments is 1,430 pounds.

Pratt & Whitney Co.

620.5 v. 25 pt. 2

The Electrical Equipment of the Nordberg Manufacturing Company's Plant.

The Nordberg Company has recently moved into a magnificent new shop in the outskirts of Milwaukee. The products of the company comprise mining, ore dressing, pumping and other heavy steam machinery, and the new works have been designed especially for this class of work. The plant is electrically driven throughout and, with the exception of those in the toolroom, all tools are fitted with individual motors. The multiple voltage system of distribution is employed, the equipment for which, with the exception of the generators, was supplied by the Milwaukee Electric Company. The electrical engineer in charge of the work is Mr. Jacob Cloos, a Milwaukee specialist in machine-shop electricity, to whom we are indebted for much of the information contained in this article.

The object of the multiple voltage system is to obtain variable speeds in the

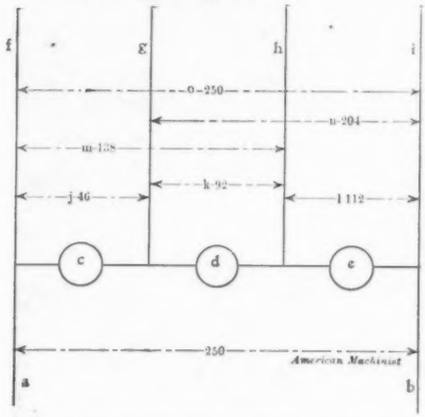


FIG. 1. CONNECTIONS OF WIRES AND EQUALIZER IN MULTIPLE VOLTAGE SYSTEM.

motors, with a wider range of variation than is possible with simple field rheostats. In this plant the two methods are used together, the range obtained with field control being added to that given by the multiple voltage system, resulting in a combined ratio between the lowest and highest speeds of not less than 1 to 7½.

The principle of the multiple voltage system is shown in the diagram, Fig. 1, in which *a b* are the mains from the generator, the full voltage between them being 250 volts. Connecting these wires is the compensator or equalizer, which, while a self-contained machine has three armature windings represented by *c d e*, the action of which is to divide the total voltage into three steps and deliver the divided voltages to the wires *f g h i*, which are the distribution wires leading to the shop. The voltages between the distribution wires are indicated by the arrows *j k l*. The controllers, which are similar in appearance to, though much smaller than street-car controllers, connect the motors to either of the voltages *j*, *k* or *l*, giving for each a different speed. Additional notches in the controller connect the motors in such manner as to give the combined voltages *m*, *n* or *o* and after the speed due to the full voltage *o* is reached further movement of the controller handle throws in the field resistance and adds still further to the speed. This field resistance is also used between the different steps to give uniformity to the speed series, the field resistance as well as the armature voltage being determined by the controller, thus giving ten total speeds. The fields are at all times excited by the full voltage *o*.

Motors which are not required to have a variable speed, as, for example, those driving planers, are connected permanently between wires *f* and *i*.

The equalizer referred to above and indicated in Fig. 1 by *c d e* is shown in Fig. 2. It is one of the prettiest of electrical machines and is based upon the fact that a dynamo may act as either a generator or a motor and may change instantly from one to the other without adjustment and without even indicating in any way how it is at the moment acting. It is, in appearance, two machines mounted on one base, but in action it is three. The machine at the right has two armature windings and two commutators —one of the latter being located at each end as indicated by the wires leading from the machine. The machine at the left has but one armature winding and one commutator. Had the system been laid out

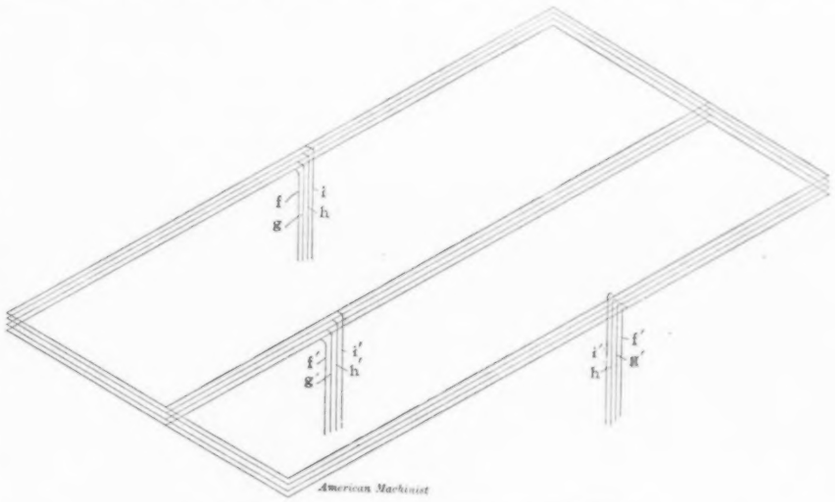


FIG. 3. OVERHEAD WIRING SYSTEM AND CONNECTIONS.

for four primary voltages the two machines would have been alike in this respect. With three voltages three machines might have been used, but with no advantage and at increased cost. The right-hand machine through its two windings acts as two machines, and for the purposes of description it will be easiest to consider it as such.

Turning back to Fig. 1 we may then consider *c*, *d* and *e* as three armatures mounted on one shaft and connected in series between the generator leads *a* and *b* with wires *f g h* and *i* leading off to the shop. The fields are connected between wires *a* and *b*. With the generator in action and delivering the full voltage between *a* and *b* and with no motors con-

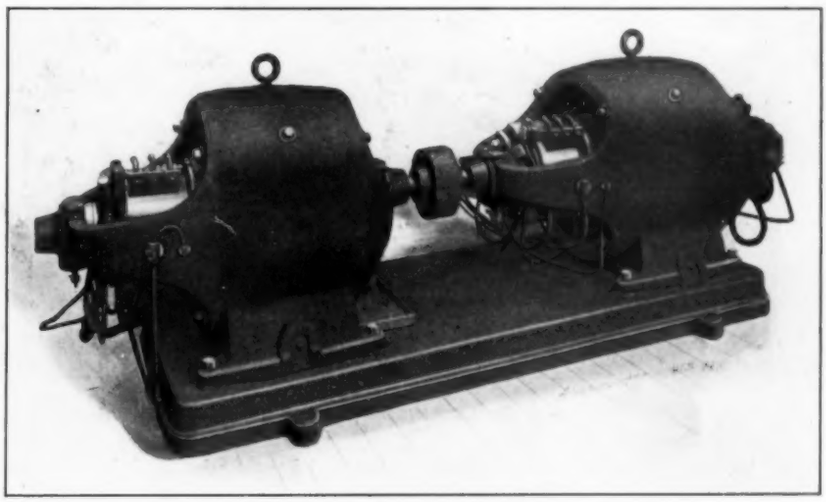


FIG. 2. EQUALIZER FOR MULTIPLE VOLTAGE SYSTEM.

nected to the distribution wires, the current will drive the equalizer, each armature acting as a motor, which, however, does no work except to keep itself in motion. The machine is then in the condition of a motor running under no load, and its action may be explained by reference to a motor under such conditions. Imagine a motor connected between wires *a* and *b*. Should such motor be short circuited or should it be blocked and held from turning, a rush of current would take place between *a* and *b* and the dynamo would be unable to maintain the required voltage between the wires, which voltage would be determined by the resistance of the connecting wire, supposing it to be able to carry the current. With the motor in motion, however, a counter electromotive force is generated in the armature which dams up the current and maintains the voltage. The action of the compensator is the same except that the damming back is done in three steps instead of one, each armature generating a portion of the counter E. M. F. and at the intermediate points between the armatures the wires *g* and *h* are led off to the shop. The windings are such as to generate the respective counter E. M. F.'s shown in connection with the arrows *j k l*. This action takes place with no load on the motors connected to the distribution wires and it is also the action with any load on those motors provided the loads on all the circuits are equal, the armatures acting as idle motors whose only function is to split up the voltage. Under these circumstances the only change is in the action of the generator in the engine-room which varies its current to meet the varying demand. Should, however, the load between any two of the distribution wires, as *f* and *g*, be increased, armature *c* instantly becomes a generator to supply the increased current required and maintain the desired voltage between *f* and *g*. Armatures *d* and *e* still act as motors, but instead of running idly they deliver the power necessary to drive *c*. Should the load be increased between both *f g* and *g h*, armatures *c* and *d* both act as generators, which are driven by *e*. Similar action takes place under all possible combinations of unequal load between the circuits, the armatures acting now as motors and now as generators and changing instantly from one to the other as the loads on the different circuits vary, and maintaining at all times a constant voltage on the different circuits. It will be observed that from the nature of the case the capacity of the armatures need be only such as to take care of the *difference* between the loads on the various circuits. It hence follows that, as in the present case, a small machine suffices for a large works.

The system of distribution at these works has many features that are novel.

FIG. 4. VIEW OF MACHINE BAY SHOWING OVERHEAD WIRING SYSTEM AND COLUMN TERMINALS.

Taking the heavy-work wing as typical of all, the distribution mains are shown in Fig. 3. This wing has a high erecting bay and a lower one-story machining bay. Dividing the two is a row of columns carrying the runways of the cranes for both bays. Surrounding the entire structure, and above the crane runways, is the outer rectangle of wires shown in Fig. 3, the connecting set of wires crossing the rectangle being strung on the runway of the machining bay crane. These wires are clearly shown in the half-tone of the ma-

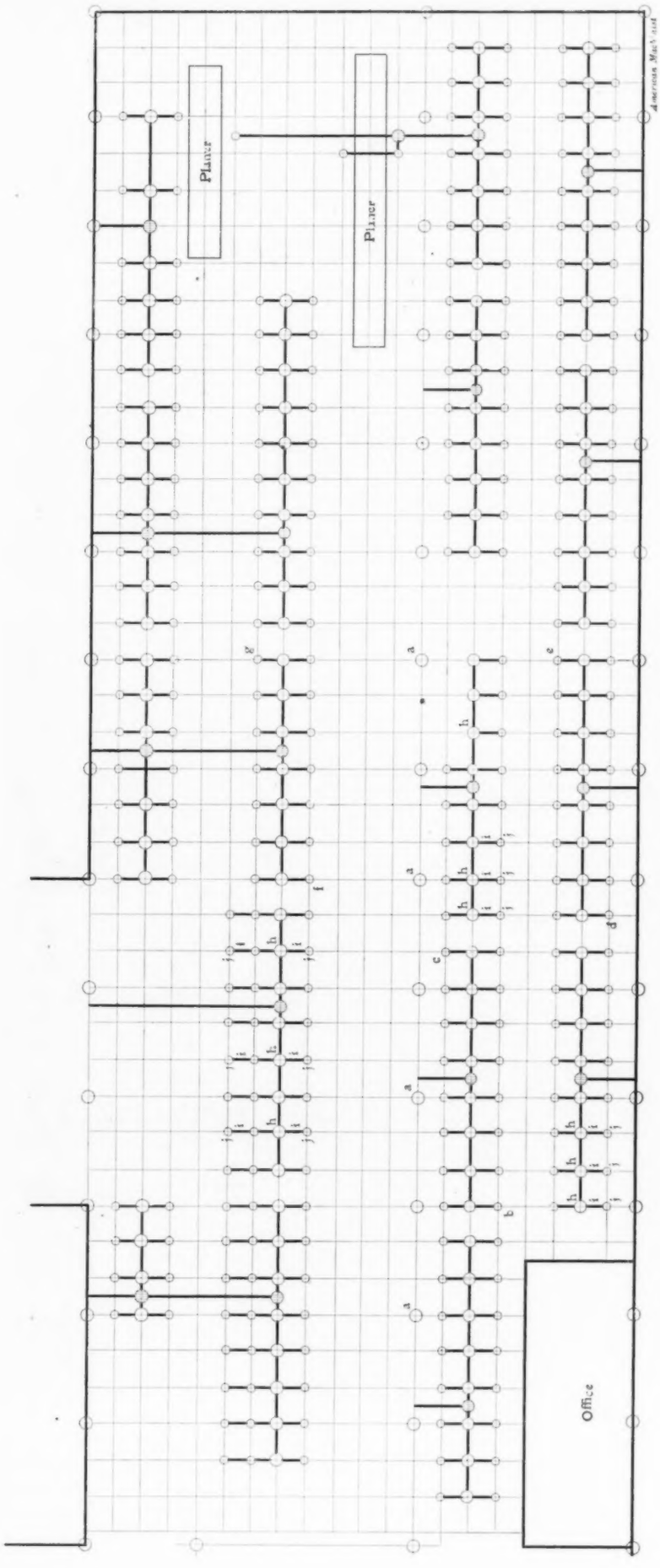


FIG. 5. ARRANGEMENT OF CONDUITS BELOW THE FLOOR.

chining bay, Fig. 4. If the reader will imagine the shop to be transparent and himself to be in a balloon looking down upon it from a distance, the wiring system would appear as in Fig. 3, which shows the four power wires. Fig. 4 shows eight wires instead of four in this set, the additional four being for the arc and incandescent lighting circuits, with which, however, we have nothing here to do. The two additional wires shown in Fig. 4 above this set are the special crane wires. At the far side of Fig. 3 the wires *f g h i*, of Fig. 1, are shown. The overhead system is simply an extension of these wires and by connecting a motor between any two of the overhead wires the effect is the same as though it were connected between the corresponding wires of the set *f g h i*, and by the overhead system this connection may be made at any part of the shop. To make this connection numerous sets of wires, of which two are shown at *f' g' h' i'*, are carried down the columns and walls. As the entire shop is fitted with overhead traveling cranes, with which the wires must not interfere, the permanent connections between *f' g' h' i'* and the motors are carried under the floor.

The shop has a cement floor throughout, which, like all such floors, is in panels of about 10 feet square, the divisions between the panels being shown by rulings in the otherwise smooth cement surface. Advantage is taken of these rulings to locate the conduits below the floor surface. These conduits are of pipe laid in the cement below these rulings with junction boxes and points for connecting wires from the various motors located in all cases at the crossings of the rulings in the cement. Fig. 5 shows the layout of these conduits for the wing of the shop already referred to. The squares ruled in light lines show the markings on the cement floor. At *a a a* are the columns between the erecting and machine shops, the former being above and the latter below the columns in the illustration. Of course it will be understood that the erecting shop is also in part a machine shop—the heavier tools being located along the sides of this bay. The conduits in the floor are divided into sections as *b c*, *d e*, *f g*, etc. Each section is fed by wires coming down the columns *a a* or the side walls, as the case may be. Junction boxes *h h h*, etc., are connected by a line of pipe and branch pipes *i i i*, etc., are carried to the terminals *j j j*, etc. As not many of the branch pipes will ever be used, and as the wires can easily be run through them as required, these wires are not initially carried beyond the junction boxes.

A section of a junction box and a branch conduit are shown in Fig. 6. The cover plate of the box has a corrugated surface. The terminals are in most cases simple pipe els properly plugged, though in some cases, as in Fig. 6, a branch contains both a tee and an el. The plugs of these tees and els are covered up with the cement,

but, as they are located at the crossings of the floor markings, it is only necessary, when a connection is desired, to drill through the cement at the most convenient crossing and remove the plug, when the wires may be run through to the nearest junction box. In case of change, it is only necessary to replace the plug and fill the hole in the floor with cement.

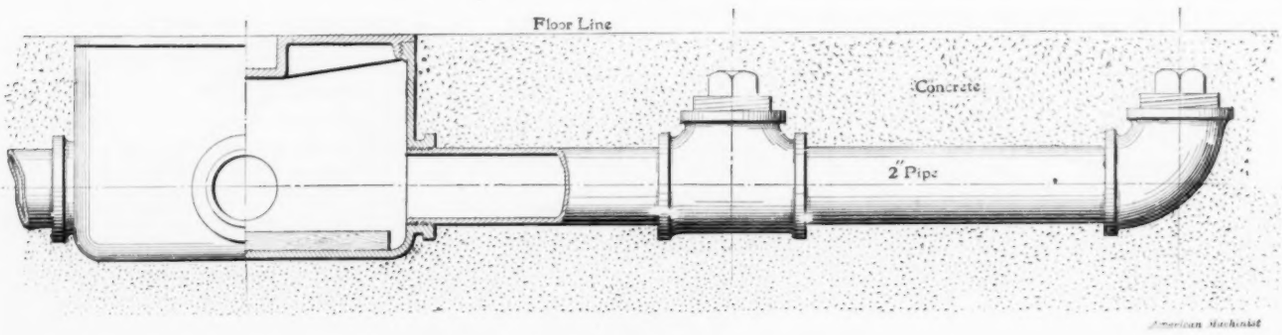


FIG. 6. JUNCTION BOX AND BRANCH CONDUIT.

In addition to the floor system each column has a terminal. In some cases these are branched from the leads running down the columns to the floor system, but more often they are connected independently to the overhead wires. These terminals will be used only for the tools which are located next the wall and for portable tools. They are shown in Figs. 7 and 8. At the right is an electric-light connection, the power terminal being at the left and fuses for the four power circuits between. The terminal is a square opening in a board with a gravity operated cover. On the four sides of the inner square are four spring-backed copper strips, shown in Fig. 7, which are the final ends of the leading wires from the system above. To make connection with a motor, a wooden plug with four corresponding copper strips which end the motor wires passing through the plug, is inserted in the opening, as shown in Fig. 8. Several of these column terminals are shown in Fig. 4.

Several methods of supporting and connecting the motors to the tools have been devised, and as this is getting to be a very live subject among tool builders we show them in considerable number and variety. In some cases they represent new work "out of the whole cloth," but in others they are adaptations to existing machines and circumstances.

Fig. 9 shows one of several new 20-inch lathes in which the method of mounting the motor is obvious. The slack of the belt is expected to be taken up from time to time by raising the platform by the spanner nuts at the bottom of the supporting columns. In the case shown the motor is a constant speed machine, the variations in speed being obtained with the cone pulleys. These lathes were ordered before the multiple voltage system of varying the speed had been decided upon. That system has been found to be so satisfactory that these motors will be rewound for it and the upper cone pulley will then disappear, as in the cases of the next two examples. While this method of supporting the motor is not so satisfactory as those which follow, it will not be changed. Figs. 10 and 11 show the approved method of supporting motors for tools in which short belts must be used. The motor is supported upon a swiveling platform with a threaded brace rod for taking up the slack of the belt. At the left of Fig. 10, standing on the floor, is the controller, and to change the speed it is only necessary to swing the handle to the proper notch. This ease in changing the speed is the chief advantage of the multiple speed motor. It is considered that with this plan the workman will change to the proper speed when, with the effort and pole accompaniment of the cone pulley system, he many times would not. Near the bottom of Fig. 11 will be seen the connection with the conduit in the floor. It is obvious that the plan shown in Fig. 11 is equally applicable to cone pulley driving with constant speed motors, with the added advantage over Fig. 9 that the belt may be maintained tight on all steps of the cones, even should they not be laid out correctly, as they sometimes are not when the center distance is so short.

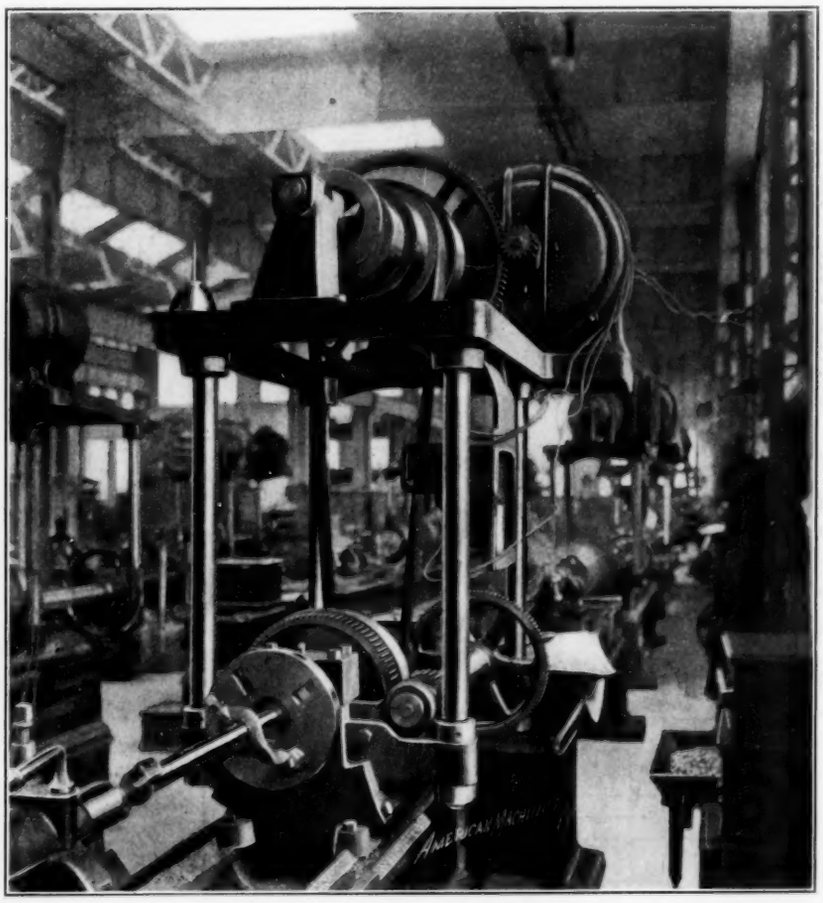


FIG. 9. RIGID SUPPORT FOR MOTOR.

Figs. 12 and 13 show the method of Figs. 10 and 11 adapted to milling machine and horizontal spindle boring machine driving, respectively. Variable speed motors are used in both cases.

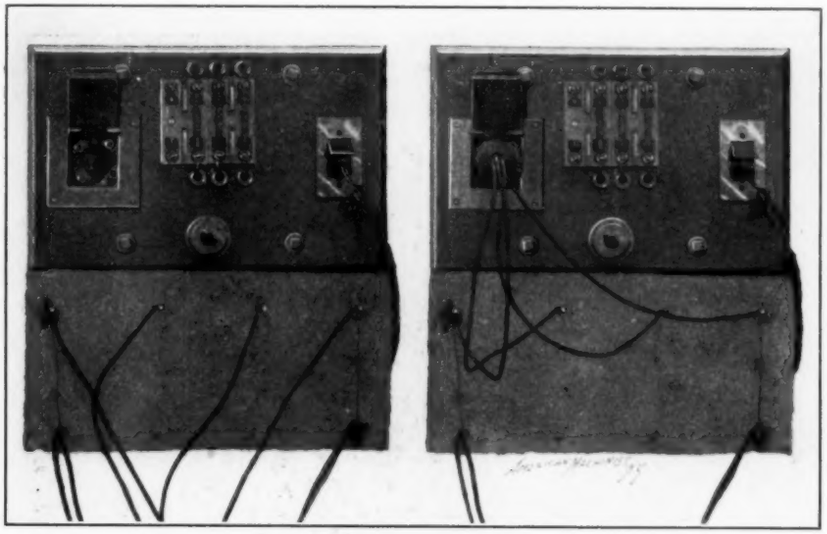


FIG. 7. COLUMN TERMINALS. FIG. 8.

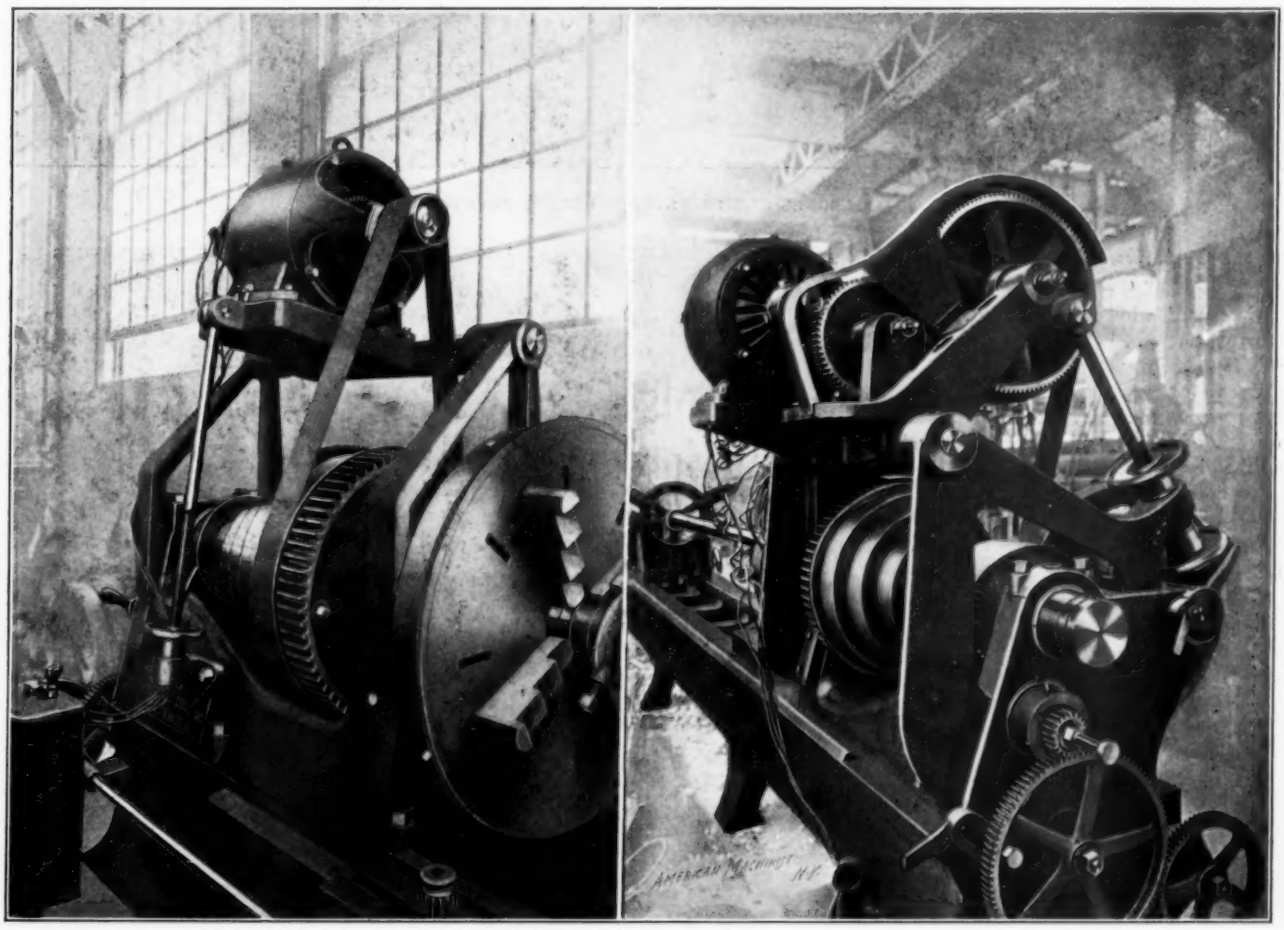


FIG. 10. SWIVELED SUPPORTS FOR MOTORS. FIG. 11.

Figs. 14 and 15 show two boring mills, the former having a variable and the latter a constant speed motor. In the case of a boring mill the range of speeds required is so great that it cannot be obtained through even the multiple voltage system of varying the speed, and so, in Fig. 14, the back gears are retained. The cone pulleys have, however, disappeared, the motor giving the range of speeds which would be covered by them. In Fig. 15 the cone pulleys are retained, the motor having a constant speed. These two machines stand nearly back to back and the rear of the machine shown in Fig. 14 with its motor appears also in Fig. 15. Separate motors are used for operating the cross rail, as will be seen in the more distant machine of Fig. 15.

Fig. 16 shows a magnificent new Bement-Miles 10-foot planer. The structure for carrying the countershaft and outer bearing of the driving shaft was supplied by the makers, and is a very satisfactory arrangement. The ways of this planer are —both of them—flat with side gib fitted to one of them. Flat ways for large planers are undoubtedly growing in popularity. The large pulley of the countershaft has a heavy rim to act as a flywheel in assisting the reversal of the machine and the motor has a compound wound field for the same purpose. This method of winding motors for driving planers is now universal and was, we believe, first described in our columns. Fig. 17 shows an older Bement-Miles planer with the method of connecting the motor, which has more of a home-made appearance than has Fig. 16 but which is not less effective. The structure for carrying the countershaft is made of pipe.

The wiring shown in some of the halftones is of a temporary character due to

the necessity for despatch in getting the tools at work. The delay in moving was not increased to any appreciable extent by the change in the system of driving the tools, although to save delay temporary wiring was resorted to.

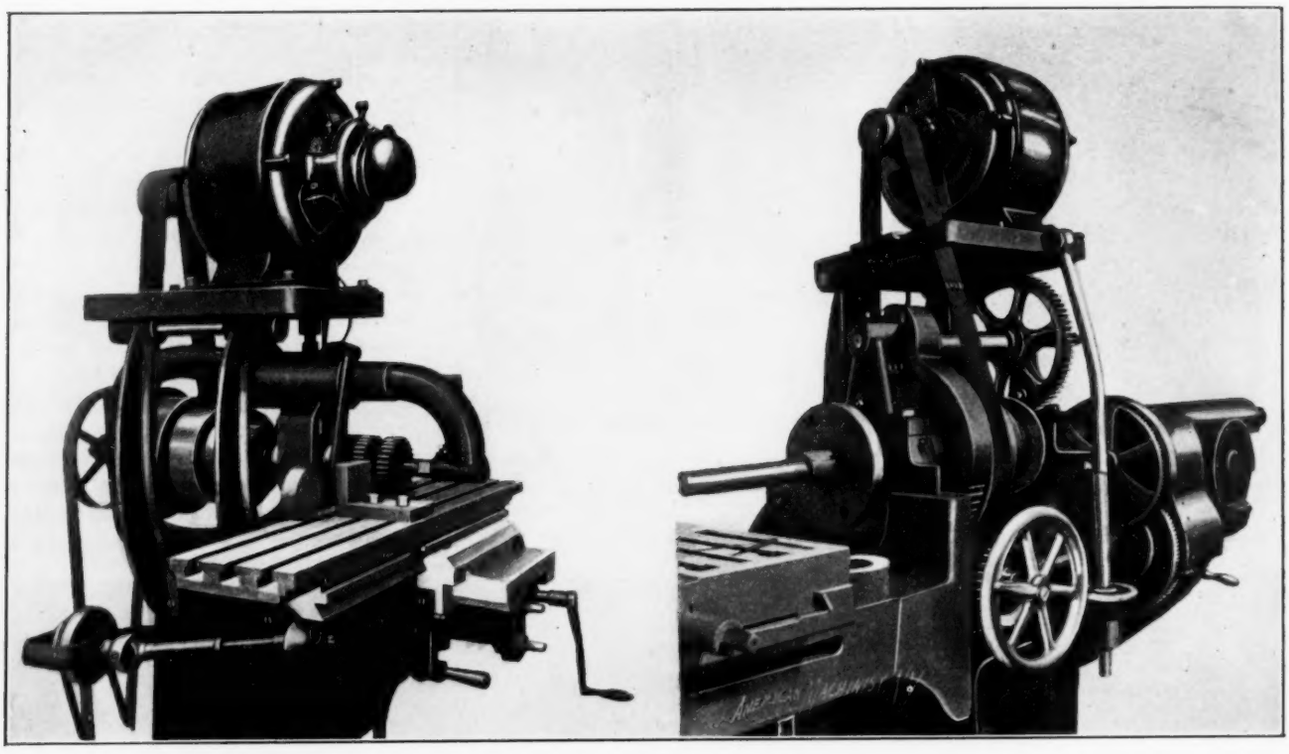


FIG. 12. ADDITIONAL CASES OF SWIVELED MOTOR SUPPORT. FIG. 13.

Brass Melting.*

BY CHAS. VICKERS.

Compared with steel or iron, it is an easy matter to melt brass. On a small scale it is frequently melted in an ordinary heating stove or on a forge (in the latter case, however, a temporary furnace must be formed of brick, and the crucible coked up therein). Such crude methods, though, are suited only to the amateur, or where a small breakdown job is needed in a hurry by some firm not having the ordinary melting facilities.

When brass is melted on a large scale the furnaces are a very important part of the plant, and it pays to do considerable thinking and figuring before building them. The character of the castings to be made must always influence the size of the furnace, as small furnaces are much more economical for the production of small and light castings than large ones. This is a thing not always considered, however, so that it is a common sight to see a "thirty" pot put into a furnace intended for a "hundred." The coal dealer may never kick at this, but his customers often do at the size and frequency of his bills.

Here then is one point in brass melting: whatever the size of the furnaces, 3 inches of solid fuel around a crucible will do as much work as 6, and is more economical in fuel, labor and metal. The fuel saving is apparent without a thought. The labor saving requires a little more effort to perceive. We must consider the extra shoveling and "poking down" required by the larger furnaces, while as to metal saving some people may not see that point at all unless it is explained. Therefore, the larger the fuel surface the greater the heat thrown towards the furnaceman when he removes the cover, and the greater the temptation to stand away off, and "peg" the metal at the crucible when the for man isn't looking. Some melters become quite expert at hitting the crucible, and most of the metal charged finds its way therein; but they can never overcome the splashing when a chunk drops into the liquid contents of the pot, and most of these splashes

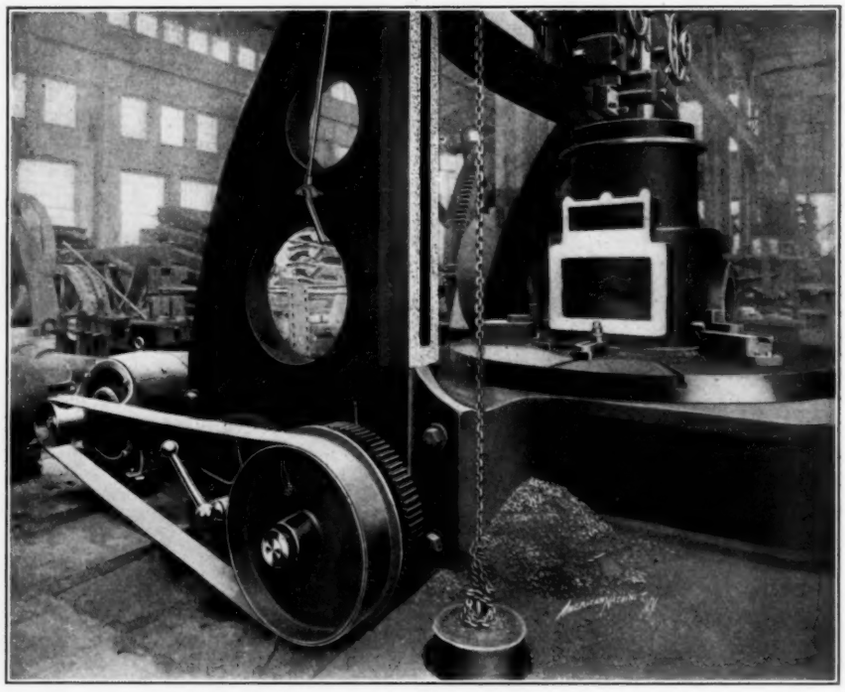


FIG. 14. BORING MILL WITH VARIABLE SPEED MOTOR. BACK GEARS RETAINED.

*At the Boston Meeting of the American Foundrymen's Association.

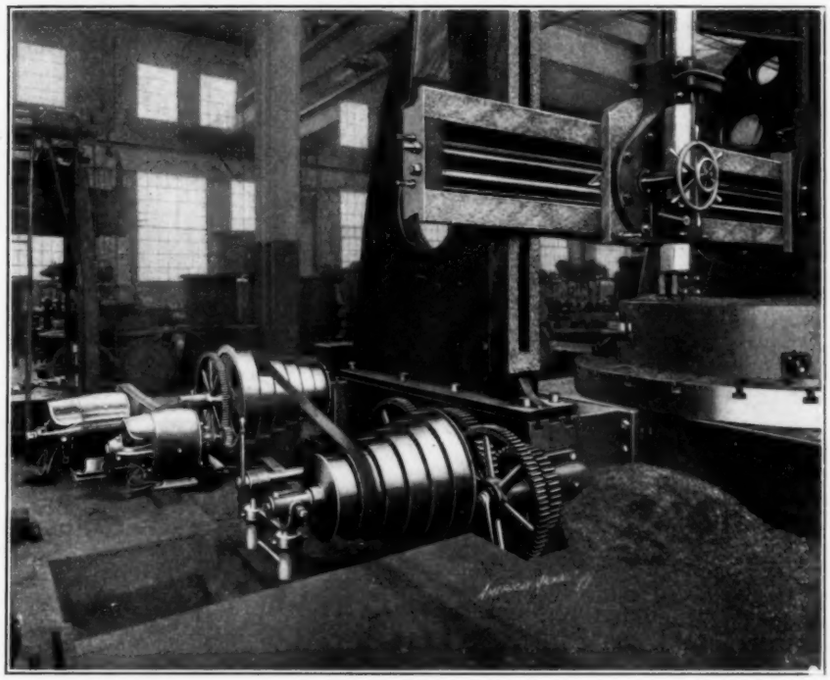


FIG. 15. BORING MILL WITH CONSTANT SPEED MOTOR AND CONE PULLEYS.

are lost in the fuel and they are metal, so this is bad practice and generally costs more than the loss of fuel. Another little point to be considered in economical melting is never to charge up a pot unless one is reasonably sure that the molds are going to be ready when the metal is, because it costs money to "hold" a pot in the furnace, as is frequently done. Then again the much abused crucible will wear away as much or even more when only half-filled than when filled.

And still again, never build or allow your furnace to become "barrel shaped," hi-falutin theories to the contrary, notwithstanding. A straight wall is always the best.

As far as we have gone with these remarks, no particular style of furnace has been recommended as being better than others, because most brass-founders have their own theories in this respect, and although they may differ in minor details most solid fuel furnaces bear a general resemblance to each other, so much so that there is another defect so serious and so universal that lots of good strong language might with advantage be used thereon. Not that there is any intention of using strong language here, we will leave that in the shop mixed with the gas that causes it, and in a few mild words explain the trouble, and suggest a remedy. As before mentioned, this trouble is caused by gas, the products of combustion being too often driven into the shop, polluting the atmosphere to such an extent that the health of the human beings employed therein is seriously endangered. For molders are human beings, although some people seem to doubt it and think that anything will do for people employed at such dusty, dirty work.

Many founders imagine that when power is applied to furnaces it is impossible to carry off all the gases, and so it is, with flues adequate for natural draft, but when the air supply to a furnace is increased by the application of a fan beneath the fire the flue area also must be increased, unless the same was abnormally large before the fan was applied. So if there is gas in your shop your flues are too small; the remedy is to enlarge them. Do not go to the trouble of cutting holes in the roof or to the expense of placing ventilating fans, which you will find are failures so far as removing the gases is concerned. And right here, let me impress the fact that it is not always the main flue which is faulty; most founders make this generous in size; turn your attention to the flues connecting each furnace to the main flue. Your foreman may pooh-pooh the idea and advance all kinds of theories to the contrary, but do not listen to him; he needs educating on this point, and see that he gets it, or get a new foreman.

There is no evading the fact that if a flame is driven from beneath the covers of furnaces the products of combustion are being driven into the workshop instead of

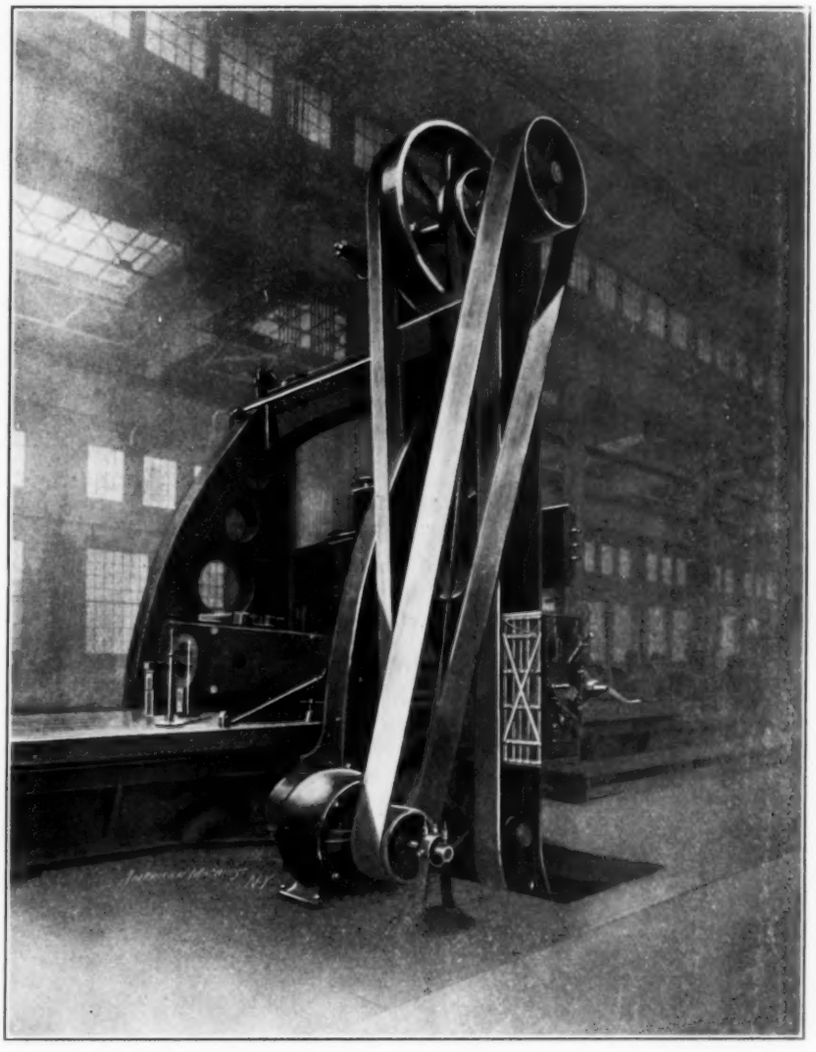


FIG. 16. TEN-FOOT PLANER AS ARRANGED BY THE MAKERS FOR MOTOR DRIVING.

through their proper channels into the outer air, where they are harmless. In place of driving air through a furnace, in some few cases the fan has been placed in the flue and by exhausting the air therefrom has created a strong draft through the flues, the furnace being operated the same as natural draft; that is, with open ash-pits. With this system a high chimney is not necessary, and the atmosphere of the shop is entirely free from contamination by the products of combustion. It possesses one disadvantage to careless people, and that is that the flues and their connections must be kept in good condition; should they be permitted to fall into decay the melting capacity of the furnaces would diminish in proportion to the air leakage. For this reason brick flues are not so well suited to this system as are iron ones, because the average brick flue, built by the average brass melter or his foreman, is never built as well as the poorest bricklayer would do it, and consequently rapidly crumbles under the racking effects of expansion and contraction.

When sheet iron is used for brass furnace flues, they are best when made circular with rectangular cast-iron connections to each furnace; the main sheet-iron flue must be suspended and not allowed to touch a wall or any non-conductor, if the air has free access to it the flue will rarely become red hot, and will consequently give good and economical service.

If the heat radiated from the flue troubles the melter, which it probably will, do not sheathe it in asbestos, or you will soon have nothing but an asbestos paper flue and a poor one at that, but hang a curtain of asbestos in such a manner as not to touch the flue, but still shield the melter.

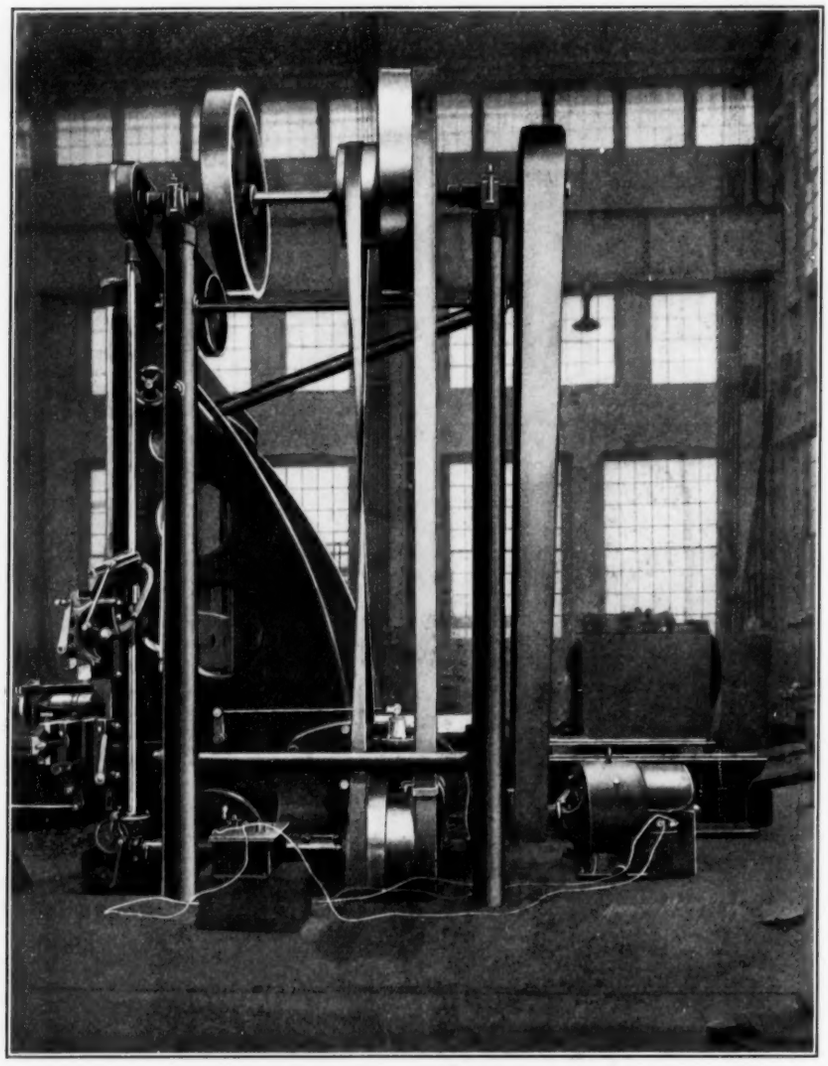


FIG. 17. LARGE PLANER AS ARRANGED BY THE USER FOR MOTOR DRIVING.

Making Spoons.

This is to describe the making of a common spoon. Most graded and stamped spoons are made of german silver, which is a stiff, strong metal for these articles. First, we order our sheet stock from the rolling mills to the correct sizes needed for each size of spoon to be made. The width, thickness and length, being determined by previous experience, gives us the stock ready for the blank chopping press, this being the first press operation. The cutting of these first blanks is one of the most interesting operations, as they are cut without any waste, cutting two blanks at each stroke of the press, while only one cutting die and punch are used. A shearing-off cutter is attached to this die, which makes a parting cut at the proper distance from the die to make a second blank. Fig. 1 will show this blank chopping process. *A* gives the shape of the chopping die, and *B* the location of the parting shear at the lower end of this die. The small strip of metal *D* is all the waste there is at each end of the long strips. *C* shows where the parting cut comes as the strip is moved forward for the succeeding cuts. The dies are of course fitted with proper gages, strippers and necessary means for quickly handling this work.

Having finished the first operation of blank chopping, we leave the press work for a while and go to the cross-grade rolling mills, which prepare the stock for what is termed "grading." By this it is meant that the blanks will be stretched to the proper length, as they are only about one-half long enough for the finished spoon and of an even thickness when first cut. We cross-roll both the bowl and handle ends of these blanks, this usually being done one end at a time, but sometimes spoon blanks are of such a shape that both ends can be rolled at the same pass. Our process will be with one end at a time. We first cross-roll the part making the bowl. Fig. 2 shows the shape the blank takes in this rolling. The third operation will be that of cross-rolling the end which makes the handle, giving the blanks the shape as in Fig. 3. We now have both ends of the blank cross-rolled, giving them nearly the proper thickness for the first grading or lengthening process.

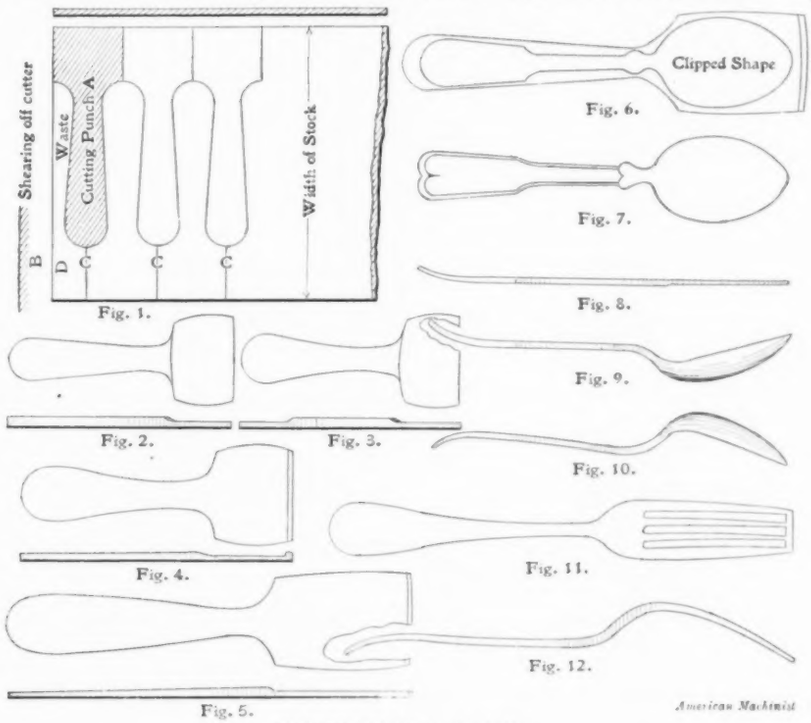
The next handling is the first pass of grade rolling, which gives the metal the first stretching operation (see Fig. 4). After this operation the blanks receive their first annealing. Then they are pickled and cleaned and made ready for their final rolling, which stretches them to their required length, giving the various parts their proper thickness. This last rolling leaves the stock as in Fig. 5.

Now we come again to the power press, the blanks having been again annealed and ready for clipping or trimming to shape. This is done by dies and punches. Fig. 6 shows the spoon and the waste around the clipped shape.

This trimmed, spoon-shaped blank is next taken to the buffing wheel, where it is made smooth and free from the trimming cutter burrs, or other roughness caused by handling, as a very clean surface is required for the next operation, which is called "stemming." That is the stamping of the handle part only. From the graded blanks, Fig. 5, many different shapes or styles are cut or clipped, and various patterns are stamped on to the handle, that being one of the reasons why

the entire spoon is not stamped, bowl and all, in one die. Some designs are made in one blow of the stamping hammer, but they should be very plain. Where the handle stamping is done in a separate die a single bowl stamping die may be used on a great many different stamped handle designs. In this way many expensive dies are saved and still a great variety of spoons may be made. Our spoon now looks like Fig. 7.

The spoon, as we will now call it, is again taken to the polisher, who, with a rather rough wheel, "fins" the edges, or cuts off the roughness caused by the stamping dies. These fins are very small on german silver work, as the blanks are cut so close that they just fit into the dies and fill out the design, leaving scarcely any flash or fin, at least not enough to cause them to go to a trimming or second clipping die. The



MAKING SPOONS AND FORKS.

expert polisher can cut and polish this fin away, leaving the spoon or fork very smooth.

After this polishing, we take these stamped spoon handles to a small bench foot-press which has a suitable set of handle-end shaping dies in it. With these the proper end form is given this handle, more for the convenience of the bowling operation than for any other reason. By this means the stamped design on the handle can always be placed into the bowling die the right way up. Were it not for this end shaping which acts as a guide for the stamper, many spoons would be stamped the wrong way about, spoiling them (see Fig. 8).

Now we have the spoon ready for bowling; this is done in a drop hammer. This tool stamping also gives the stem a partial shape which is shown in Fig. 9.

The spoons are now ready for their final polishing and buffing, which is a trade in itself, requiring a great deal of skilled labor, as no hand filing or finishing is done on the german-silver goods as usually made. After this last polishing, the spoons are placed in a shaping die, which is often made of hard wood (sometimes copper faced) having the exact shape of the finished spoon. Hard wood is used for these dies, to prevent the fancy designs being marred or destroyed by this operation, as would be the case if iron or steel dies were used. These dies are usually used in a foot-press or a light bench hammer. Sometimes special bench hand hammers are made, each hammer having its own form or shape in it. This makes a very convenient tool for the purpose, as no die or shape changing is required. Fig. 10 shows the finished shape of a teaspoon. The next operation is that of stamping the trade mark or maker's name or branding them with such marks as may be customary for the many different patterns or styles. After this the spoons are ready for silver plating, burnishing, inspecting and packing.

German silver forks are made practically in the same manner as the spoons, only instead of bowl stamping we have what is called the tining operation—that is, cutting the tines into the end of the clipped blanks, as shown in Fig. 11. This fork tining is usually done in a special press for this purpose, which cuts the tines one at a time, cutting the center one first, automatically working the three cuts and then stopping. This is a very ingenious device for the purpose, doing the work with great accuracy and rapidity. The ends of the tines are left tied, to prevent their spreading while the stamping is being done. It also prevents the points of the tines (which would be sharp were it not for this front tie piece) from piercing the operators' hands or tearing the polishing belts. This end tie piece is cut off just before the last tine polishing is done. A small foot press is generally used for this purpose. Sometimes when forks are of a plain pattern they are stamped in a heavy drop, both the handle and tines in one die, with one drop blow (see Fig. 12).

The shapes shown are as they actually appear when taken from the dies in which they are cut or stamped. Sterling silver spoons and forks are made in much the same way, only that more hand work is applied to them; there are several more stamping and trimming operations as well as a great deal of hand filing. Graded steel spoons are made more along the lines of german silver ones. There are of course some steel spoons made which are not graded, but are made from stock of even thickness and stamped with heavy ribs to strengthen the handles. The power press and the drop hammer are great factors in spoon making. The grading rolls also perform important parts. F. CANDOR.

Down East.

A Successful Evening School.

As the AMERICAN MACHINIST is always interested in anything pertaining to the education of the apprentice and the shop mechanic, an account of the Richmond Technical Association, whose example might be followed to good purpose in other localities, will no doubt be of interest. It was organized in January last, in Tottenville, Staten Island, by a number of young men working in the shops in the vicinity, in order to give themselves a better education, there being no available night school of any sort. Many of the organizers who had paid for scholarships in correspondence schools realized how expensive they were and how much better personal instruction would be. There can be no question in my mind that solitary study through the tedious system of correspondence with a teacher miles away discourages many a bright student, who, were he in a class-room in which existed a healthy feeling of rivalry among the students, and under an instructor with personal help and encouraging words at the proper time to ease over the disheartening set-backs, would become a more capable thinker and doer in the industrial world.

These young men met in the office of the Murray Manufacturing Company, of Richmond Valley, Staten Island, to talk the matter over with Mr. L. A. Murray, of the firm, and Mr. H. E. Harris, chief draftsman, and decided to organize as a fraternal association and invite others to join. The benefits were to be an opportunity to obtain evening instruction in mechanical drawing, physics and mathematics

at a small cost to the students. They decided that the first term should last four months as a trial—February, March, April and May, 1902. Each member paid $2 upon enrolling, the amount to be repaid by the treasurer at the end of the term to those who had attended at least seven-eighths of the time. The current dues were set at 25 cents per week, this amount permitting a member to attend one or all the classes. A board of officers was elected, consisting of president, vice-president, financial secretary, recording secretary and treasurer. School discount prices were obtained from a well-known apparatus and drawing instrument company of New York city, and material was distributed among the members at cost prices.

The Board of Education allowed the use of a room in the public school house in Tottenville for class meetings, which were held twice a week for mechanical drawing, once a week for mathematics and once a week for physics. Mr. Harris' services were obtained as instructor in mechanical drawing at a figure which the association could easily afford, and Mr. N. J. Lowe, High School Principal, volunteered to teach mathematics, and Mr. Harris, physics.

The local papers were quite enthusiastic and gave the project quite a boom, with the result that many new faces came drifting in on the first enrollment night. The membership was about thirty-five—quite large for this section—and only a minority resigned from their membership during the term.

The enrollment fund put it on a sound financial basis at the start, and lamps were bought, supplies were ordered and janitor's services for opening the school-house and tending the lights were secured. The members are still enthusiastic and the general verdict of those interested is that the association has been a grand success. An association of this kind might easily be organized in almost any manufacturing district where a few intelligent young men so desire.

Some of the students of the Richmond Technical Association have made quite rapid progress and have reached a point where they can make screw machine details from a blueprint of the assembly, and make assemblies and details from the model machines. These blueprints and models were kindly lent by the Murray Manufacturing Company, whose members have taken an especial interest in the association's welfare.

I have often seen in your columns articles upon education for shop men, advocating different methods, and as my acquaintance with them has shown me that the majority of the more intelligent shop men are eager and anxious to learn and advance themselves, I believe that this fraternal-association idea is next best to non-compulsory night school. This scheme has been demonstrated to be practical, as it has proved entirely successful and may be put in operation wherever there are one or two shops and the available talent to engage as instructors. Mr. Harris is willing to furnish any information to anyone wishing further enlightenment as to by-laws, rules, method of organization, courses of instruction or other matters pertaining to the association. H.

Notes by a Wandering Mechanic.

MILLING MACHINE VISE—SPECIAL TURRET FOR LATHE WORK—LARGE INSIDE AND OUTSIDE CALIPERS.

BY H. GOLDSMITH.

Along about the middle of May, 1900, that itching sensation to move onward began to be felt again, and noticing that the Westinghouse Electric & Manufacturing Company, of Pittsburgh, was advertising for men, I decided to pull up stakes and be off to fields of vaster knowledge and more smoke. Giving suitable notice that I was going to quit, and being advised of their

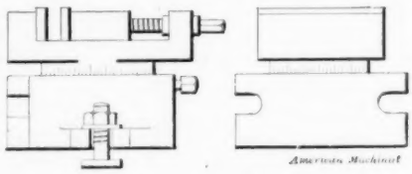


FIG. 9. UNIVERSAL VISE.

great regrets (?) to see me go, I took the night train out of Cincinnati and landed in Pittsburgh the next morning. It was my first offense in this city and I was as badly off as a fish out of water, but seeing a big, fat, good natured looking policeman (they all appear to be fat in this city) and telling him my troubles, I was given instructions as to how to get to the Westinghouse works. I arrived there about 10 A. M., and after being shown to the foreman of one of the departments and telling him my past and present experience, I was told to come to work the next day at 7 A. M. and start on electrical controllers. Well, I knew as much about electrical controllers as a butterfly knows

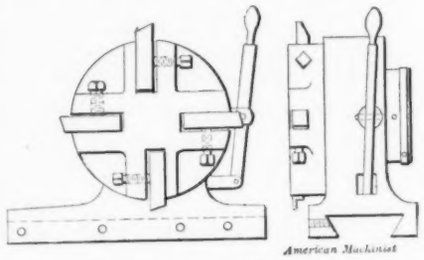


FIG. 10. LATHE TURRET.

about swimming, but I wanted to work in these shops, so I simply looked wise and said "All right." My next step was to find a suitable place to hang my clothes and rest my head at night, and having a swell opinion of the amount of money in my pocket, I decided that the Hotel Lincoln would fill the bill, so had my trunk hauled around and made my arrangements by the month. (It took me just two weeks to find out that it would be better to live a little cheaper, and cheaper headquarters I found in Wilkinsburg.)

The next day I was given some instructions as to what was wanted on those

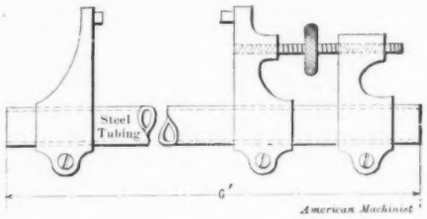


FIG. 11. LARGE CALIPER.

electrical controllers, so taking things kind of easy and keeping my eyes open, I managed to pull through that day all right, and in a week was holding down my job O. K.

To describe the large machine tools used in these shops would require a book alone, so I will confine myself to their shop system and their small jigs and original devices.

The supply toolroom is provided with a number of duplicates of every kind of tool used by the men on the many different operations. If your chisel, drill, reamer or milling cutter becomes dull, you simply take it to the toolroom and get another in its place, without losing any time to regrind or harden same.

No one can enter or leave the shop without showing his check at noon or evening, and a pass during the day, watch-

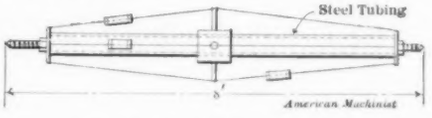


FIG. 12. LARGE INSIDE GAGE.

men being stationed at all of the doors and gates. Payment of wages is made every two weeks, and the day before it is made slips are passed around showing the amount of money due you, and, if correct, your slip must be signed and handed in when your money is paid. This is practically a receipt, and also gives the employees an opportunity of figuring a day in advance if they are receiving all "that is coming to them." The washrooms and closets are kept in the neatest kind of condition, and it makes a fellow feel that he is somebody while working for this firm, as considerable attention is paid to the personal side and feelings of the employees. They used a good many Franklin portable cranes in these works, these cranes being very useful for removing heavy work from lathes and for hauling it to different parts of the shops. A very handy milling machine and drill press vise is used there, shown in Fig. 9. Fig. 10 shows a handy tool-holder for the lathe. This is an excellent device for holding different shapes and forms of cut-

ting tools. Some of the largest micrometer gages that I had ever seen were in this toolroom. Fig. 11 shows a large caliper, and Fig. 12 a large inside gage.

A very ingenious arrangement that I accidentally stumbled against was on a 16-inch back geared turret engine lathe, with turret mounted on the bed. This attachment was for holding hand-wheels; tools and become tired at looking at them.

It took me over two months to go through the entire plant; that is, using the time I had left at noon after eating my lunch, and I believe that at the end of two more months spent in looking about there would still be plenty of new things to see.

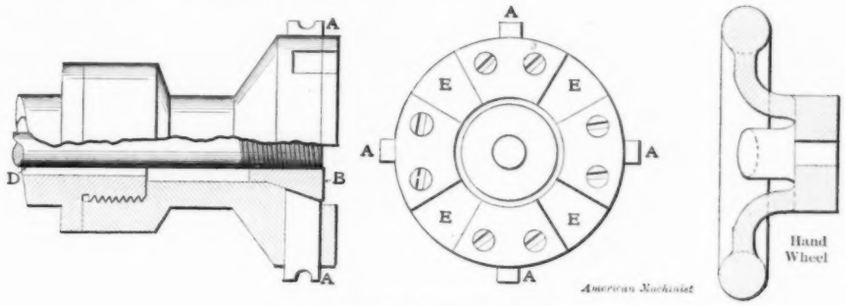


FIG. 13. HAND-WHEEL CHUCK.

the turning of the rim, boring, reaming and facing all being done in one chucking. Fig. 13 shows this hand-wheel chuck secured to lathe spindle. At *A* are sliding tool steel jaws; *B* is a hardened tool steel taper plug in contact with jaws *A*. *B* is drawn inward or forced outward by means of screw rod *D*, to which is attached a hand-wheel at the rear end of the spindle. Slots *E* are to allow the arms of

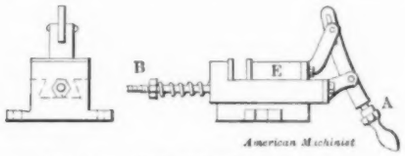


FIG. 14. VISE FOR LIGHT MILLING.

the hand-wheel to enter and act as drivers. The action of drawing in the taper plug *B* by means of the hand-wheel and rod *D* opens the jaws *A* which come in contact with the inside of the rim of the casting, holding it absolutely rigid and allowing all operations to be done without removing it from the chuck, thus saving time and producing accurate work. A very handy and quick operating vise for rapid and light milling or drilling operations is shown in Fig. 14. The opening and closing of the vise and, if necessary, feeding of the work under the milling cutter, are all controlled by one lever *A*, a good, heavy spring closing the vise jaws when the pressure on *A* is released.

The entire shop is filled with machines especially adapted for certain classes of work, and they do nothing else the entire year round; some machines are for drilling sixteen 1¼-inch holes in steel in one operation; some large arc planing machines plane up large dies for stamping out the armature segments with radii of 4 to 8 feet and larger, and there are quantities of special boring and forming tools for finishing armatures and segments, commutators, etc.—in fact you would think there would be no end of special

Details of a Lathe Job and the Time.

BY B. W. T.

The object of this article is to describe in detail the lathe work on a pump plunger, as shown in the sketch—a plain, everyday job and one that requires only fairly good workmanship.

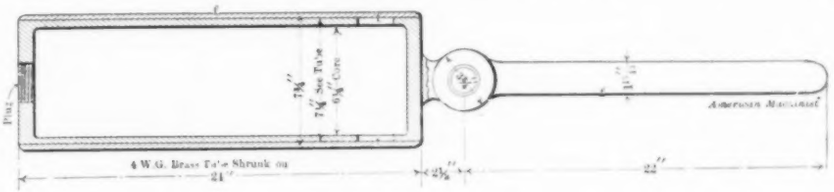
We take it for granted that the lathe is suited to the work and that the lathe tools are of the best quality, and that for handling the piece we have an air lift on a trolley over the lathe. We take a lot of ten castings to carry along together. These, like almost all castings of this class, come to us more or less crooked, and in centering the stock must be divided up. On this account considerable time is required for the centering. A good mechanic by looking the piece over can locate the centers approximately, but each piece must be put on the centers and corrected.

The sketch shows a cored hole in the end of the casting which must first be plugged with a 2-inch solid pipe plug. The reaming and tapping of this hole is done under the drill press; the plug is then put in and the square is nicked around and broken off. The piece goes to the lathe with this done, and the time is not reckoned in the total lathe work. After locating the centers correctly, drill and ream them under a drill press. The total time for centering, drilling and reaming the ten should not exceed three hours.

It will be seen by the sketch that the piece is covered with brass tubing; therefore the final finishing cut is made after the brass covering is put on. The first operation is a rough cut over the stem. Place the chuck on the spindle, use a center that is long enough to allow the piece to run clear of the chuck jaws, and at the same time allow the outer step on the jaw to set down on the piece. Place the piece on the centers and move the chuck jaws down until they all touch; then give each a slight turn more sufficient to hold and drive the work. To rough the stem the piece should run from 50 to 60 turns a minute. The feed should be about 3-32 inch and the cut should be made in from three to four minutes. This operation, if properly handled, will not consume over eight minutes for each, including the handling of the piece. In running this roughing cut at the speed mentioned there may be considerable springing and, consequently, chatter; no harm will be done as long as the piece stays in the lathe. The cut is to remove stock and scale and a little commotion more or less will do no harm. We are not looking for comfort or pleasure in this job, but for quick work. We must compete with some other fellow who is a hustler.

The roughing of the body is the next operation. Remove the chuck and put on the small face-plate. Before roughing the body it is necessary to true up a spot on the stem close to the boss for the steady rest. Do this to all of the ten pieces, and be careful to make the spots of the same diameter. In changing pieces, don t drop the dog on the floor or on the ways of the lathe, but let it hang on the center. This rough cut can be made with the piece running 20 turns a minute with ⅛-inch feed. Put a good tool in the post. (When I say a good tool I mean a genuine Mushet or equally good steel—if there is such.) Get the proper size by calipers, and when once you get the size at least five of the pieces should be roughed before it will be necessary to change the position of the tool, and therefore no calipering need be done. The bodies of these pieces can be roughed off, including the handling, at the rate of one in fifteen minutes.

We now come to the fitting of the plunger body to the brass tube covering, a shrink fit. We caliper the tubes carefully



A PLUNGER TO BE TURNED.

at both ends, noting the largest and the smallest diameters of each tube, and the average of their diameters must be used. The plunger should be turned 0.05 inch larger than the largest tube. The smaller tubes can readily be expanded by the heat sufficiently to enable them to slip over the plunger. It is only necessary when heat-

ing the tubes to know which are the small ones, so that a little more heat can be given them. If good judgment has been used in roughing it will be necessary to run only one cut in fitting to the brass. This cut should be made with a tool about ⅜ inch wide with ¼-inch feed, running the piece about twenty turns a minute. No filing should be necessary and will not be if the tool is properly set. Fifteen minutes each should make these fits. Heating and shrinking the brass sleeves to the piece are not here counted in the lathe job. If the foreman of the department is up to date, he will have a laborer do this, so that there will be no delay with the lathe work.

We next finish the brass coverings, placing the piece on the centers with the stem next to the face-plate and using the steady rest on the stem. The brass covering can be finished with one cut, provided the tube is of the same, or of approximately the same, thickness all around. Usually it requires two cuts: the first can be made with ⅛-inch feed, 20 turns per minute, using a tool broad enough to leave a surface without ridges. The last cut can be made at the same speed and the feed can be ¼ inch or more with the tool ½ inch wide on the cutting edge. Set it to scrape off a very light cut. If properly handled, this tool will leave a surface requiring but little filing. The two cuts, filing and polishing, should be accomplished in from twenty to thirty minutes each.

We now remove the steady rest, turn the piece end for end, and use a wooden clamp for a drive to avoid marring the brass. In finishing the stem good judgment is necessary in setting the tool. To avoid chatter and to give a good surface, speed the piece to about 50 turns, using ⅛-inch feed. If the proper allowance has been made for the finishing cut, but one cut need be made, this cut, filing and polishing requiring twenty minutes for each. The total time on the ten pieces, according to the foregoing figures, adding 25 per cent. for contingencies, amounts to twenty hours and the work should not require an hour more.

A friend sends us a commercial bulletin issued in Wall street, which gives an account of a steam turbine, the reason for this description being that the turbine is supposed to affect in some way the Wall Street valuation of the assets of one of the electrical companies. The description itself is unique and is, in part, as follows:

"The steam turbine is a vertical arrangement. The turbine, which is under steam pressure, runs horizontal and is directly connected with the generator which is above it. The condenser is beneath the turbine. . . There are only a few of these turbines now in practical operation in this country, one being located at Hartford, Conn. The steam turbine is an improvement over the engine and dynamo arrangement and costs considerably less."

A Complete Set of Dies for the Manufacture of Sheet Metal Hinges.

BY JOSEPH V. WOODWORTH.

The set of dies here described was made in one of the largest sheet metal goods establishments in New York. The dies are used for manufacturing sheet metal hinges and latches for grape crates, and they represent the highest attainment in the adaptation of different types of dies for the production of sheet metal parts at a minimum cost. There is a demand for over 8,000,000 of these hinges and latches annually.

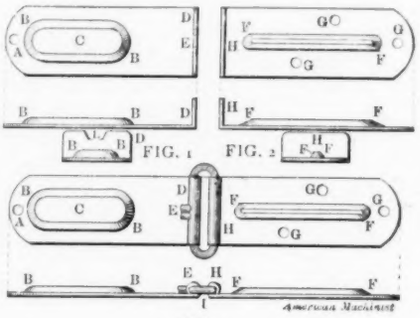


FIG. 1 FIG. 2

FIG. 3

CRATE HINGE AND LATCH.

Six dies are required to produce the hinges, and as the illustrations have been made as clear as possible, their design, construction and operation will be clearly understood with a very slight description.

There are three different parts to be made—the latch portion, Fig. 1; the attachable portion, Fig. 2, and the hinge proper, *I*, in Fig. 3. Fig. 1 is of cold rolled stock, about 1-32 inch thick. As this stock comes in rolls of the required width, it is not necessary to do any blanking. The operations to produce this part are the piercing of the small hole *A* and the long one *G*, drawing and forming the margin around it at *B B*, rounding one end and notching the other at *E*, cutting off the piece, and, lastly, bending the notched end to a right angle, as shown at *D*. All this is accomplished by a gang of punches and dies of the "follow" type. The metal is fed through the die automatically, and as the press is inclined the finished work drops off into a receptacle at the back.

The die is shown complete in Fig. 4, while Fig. 5 shows a plan of the punch and die. The die plate in which are contained the entire gang of dies (the drawing die being separated and inserted to allow of grinding) is hardened and drawn very little, while all the punches, except the drawing and bending punches, are left soft. When the face of the die plate is ground, the drawing die also is removed and ground on the bottom.

The manner in which the stock is fed through this die, and the various operations performed until the finished piece drops off at the back, can be understood from Fig. 4, in which is shown a strip of stock lying along the die plate. First, the small hole *A* and the long one *C* are pierced. At the next stroke the margin *B B* is drawn and formed, and the end *D* is notched at *E* by the cutting-off and end-finishing punch. At the next stroke the punch descends and the spring pad holds the metal securely while the notched end is being bent by the bending punch, and the finished piece cut off.

For producing the part shown in Fig. 2 a die of the same type and design as the one shown in Fig. 4 is used, the only difference being in the construction and arrangement of the punches and dies for piercing the three holes *G G G*, drawing the rib *F F* and bending the end *H*.

As shown in the finished hinge, Fig. 3, the two ends of the wire are formed so that they will project about ⅛ inch beyond the side. This is done so that when the end *D* of the part shown in Fig. 1 is curled over the wire, the projecting ends of the wire will locate within the notch *E*,

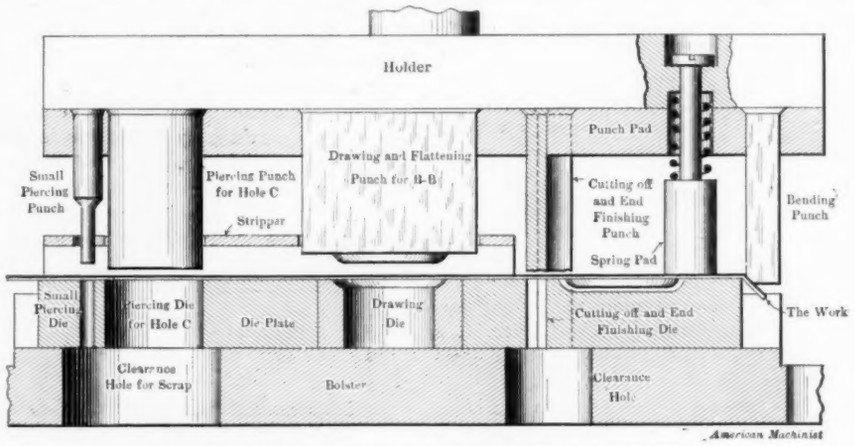


FIG. 4. PUNCH AND DIE FOR MAKING FIG. 1 COMPLETE.

Fig. 3. The piece will thus be fastened permanently to one portion, and the other will turn on the wire.

The result of the first operation in the production of this wire, here called the hinge, is shown at the right of the top view in Fig. 6. In this figure are also shown two views of the punch and die used to produce this result. In this die

the wire is fed automatically from a reel, and a piece is cut off and bent to the shape shown at the right, at each stroke of the press. In the die, *L* is the bolster, *G* the bending die, *I* the cutting die and *K* the stripper, while *H* is the plate beneath which the wire is fed. In the punch, *A* is the holder, *B* the bending punch, *E* the spring pad which holds the wire tightly upon the die while it is being cut and bent, and *C* the spring. The lower figure, an end cross-section of the punch and die, shows the stripping arrangement. As the punch descends, the stripper or knockout *R* is drawn backward by the inclined finger *N* engaging the pin *M*. As the punch ascends the knockout pin *R* plunges outward, and, as the press is inclined, the work is thrown off the punch and falls down the inclined way into a box. The rapidity with which a punch and die of this type can be worked, when equipped with an automatic stripper or knockout of this construction and an automatic feed, is astonishing.

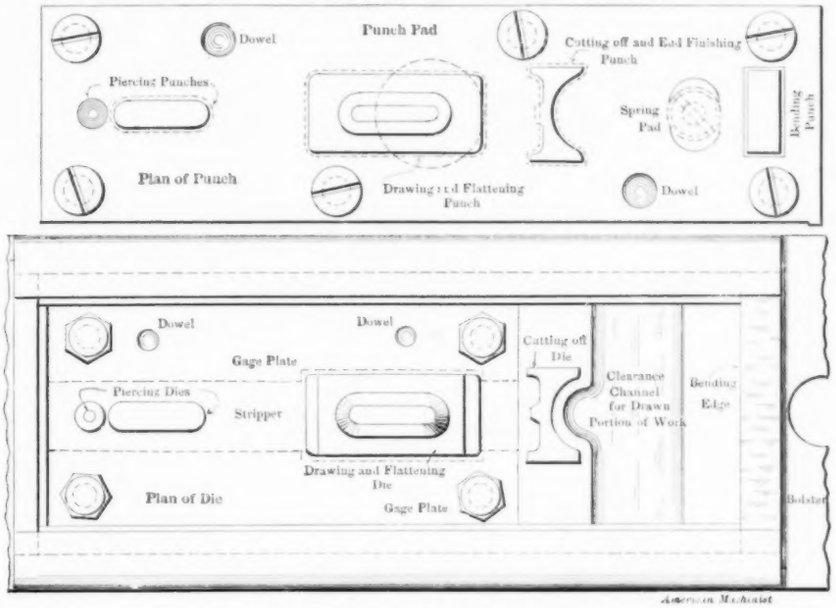


FIG. 5. PLAN OF PUNCH AND DIE.

The second operation on the hinge is by the punch and die, Fig. 7. A stripper of the same construction as in Fig. 6 is used, but, as will be seen, conditions are reversed, and instead of the stripper being fastened and located upon the die, it is upon the punch, while the inclined finger, by which it is worked, is located upon the back of the die bolster. The punch consists of the holder *S*, the bending punch *T* and the stripper *X*. In the die, *Z* is the bolster, *W* the bending die, *V V* the two adjustable gage plates, between which the work *U* is located, and *Y Y* the inclined fingers which work the stripper.

When in use the wire as bent in the first operation is placed between the gage plates *V V*. The punch descending strikes the wire and bends it into the die, while the ends spring upward and hug the punch, thus producing the shape shown at the left. As the punch ascends, the knockout pin *X* hits the work and it is thrown off the punch.

The means used for the third or finishing operation on the wire hinge are shown in Figs. 8 and 9. In Fig. 8 the work is in position as it appears before the punch descends. In this figure are also shown plans of the punch and die. Fig. 9 is a cross-section of the working parts of the punch and die as they appear when the punch has descended and the work is finished.

The punch consists of a machine-steel holder *J*, the face of which is dovetailed at *K K* to admit the two tool-steel forming slides *M M*, which have a stiff spring between them at *N*. *L L* are the stop screws for the slides, which are forced against them by the spring at *N*. The slides are hardened and tempered.

In the die *Q* is the bolster in which the tool steel locator *O* is fastened, and the adjustable roller brackets *S S* are located. The rollers *R R* are of tool steel, hardened and ground. The work is fed to the die and removed when finished by a fork in the hand of the operator.

For the last operation in the production of these articles, that of "wiring" the bent ends of the sheet metal portion around the wire hinge, a punch and die of a decidedly novel design are used, shown in Fig. 10. This is a heavy bolster with strong standards at each end as bearings for the shaft of an octagon die, which is made with eight locating surfaces for the work to allow of the press being run constantly and the work being located upon the surface by the operator without the danger of clipping his fingers. The die is

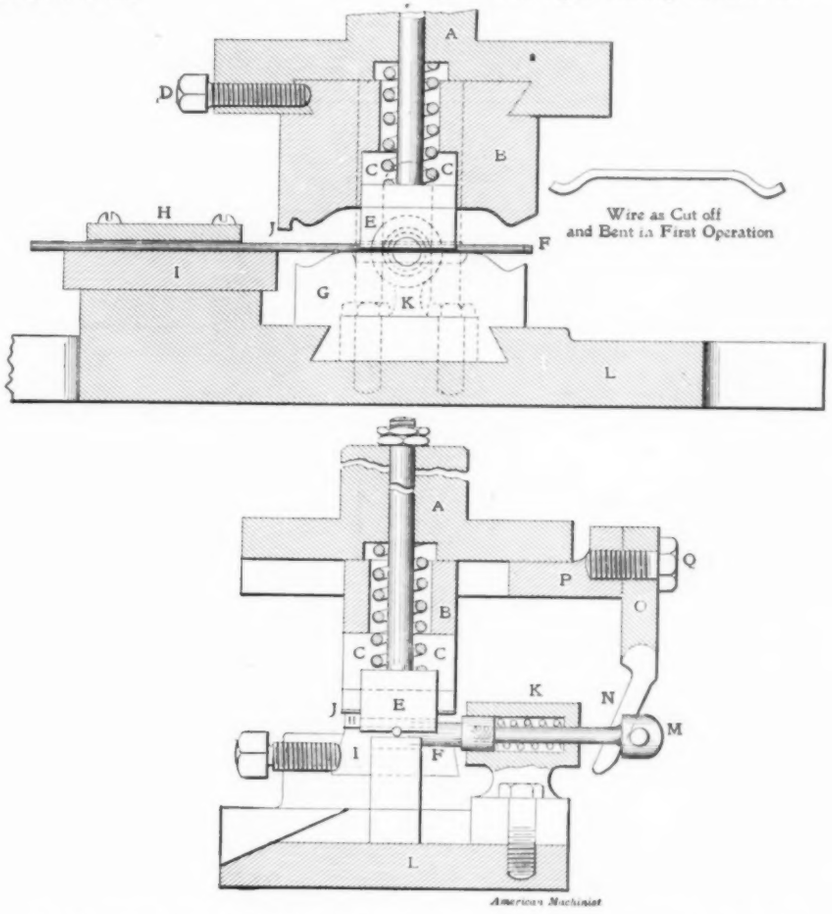


FIG. 6. PUNCH AND DIE FOR FIRST BENDING OPERATION ON WIRE HINGE, SHOWING AUTOMATIC STRIPPER.

rotated automatically by a combination of an index wheel, pawl and connecting rod, one end of the rod being attached to an adjustable stud in the T-slot in the press shaft, and the other as shown. The manner in which the work is located and finished can be seen in the front view, in which are shown three hinges in position, the lower one being the one last located by the operator and the top one as being "wired" and finished by the punch. As the octagon die is rotated, the finished work is carried away from the die and drops off at the back, while the next one is then fed to a position directly beneath the punch.

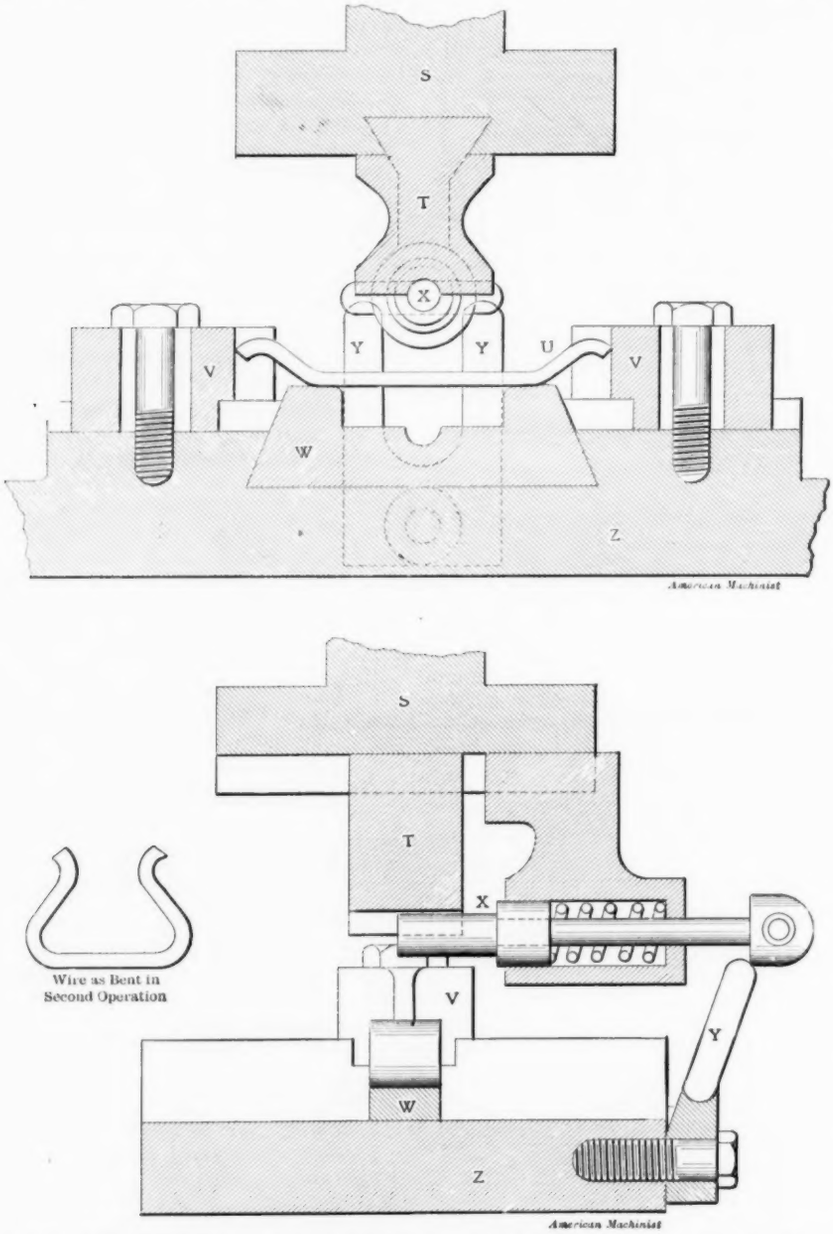


FIG. 7. PUNCH AND DIE FOR SECOND BENDING OPERATION ON WIRE HINGE, SHOWING AUTOMATIC STRIPPER ON PUNCH.

By the use of this set of dies hinges of the type shown are produced to sell for one cent apiece. Twelve sets, each set consisting of a hinge, latch and hasp, are sold for thirty cents.

The Imperative Conditions for Forging Steel.*

In order that we may fully appreciate what a delicate material steel is now known to be and therefore how intelligently it must be handled in all its stages of production from the raw material to the finished product, let us run through the processes now considered necessary to manufacture the grade of forgings which, if an engine builder desires to keep in the front of his profession, he must have supplied to his engines. Having carefully considered the service to which a proposed forging is to be put, the charge of raw material for the furnace is made up so that the finished product will have the proper chemical composition, which, from previous experience, is found to be most satisfactory. The elements, carbon, manganese, silicon, phosphorus, and sulphur, all have an influence not only on the working of the metal in the shops, but upon the strength of the forging in subsequent service. The product of the open-hearth furnace is found to give most eminent satisfaction, and has been generally adopted for making forgings. In order that the metal of a forging should be thoroughly worked to give it strength and toughness, an ingot should be cast approximately 50 per cent. larger in diameter than the finished size. Besides this increase, there should be from 10 to 25 per cent. added to its length, for reasons which will become apparent.

The extra length, having served its purpose of supplying metal to fill "blow holes" and "pipes" and of collecting "segregation," is cut off and returned to scrap. The ingot is then ready for the forging process. The first operation in the process of forging is the reheating of the ingot. This operation is a very delicate one, as great care must be taken to make the heat penetrate the metal slowly and uniformly. As already explained, the metal in the ingot during the process of cooling is being drawn out in all directions to fill the mold. When it is cold, therefore, it is in a condition of strain throughout its interior. If a cold ingot is put into a hot furnace to be reheated, the surface metal would immediately expand and pull still further away from the center, and thus an additional strain would be put on the inside metal. In very large ingots cracks are thus apt to be started in the center and forgings are very liable to break in subsequent service, from the fact that they have not been properly reheated. A great many forgings fail from lack of care being taken at this time.

Next comes the forging process proper, and one of the first requisites is the proper selection of forging tools. The pressure applied in shaping a piece of steel should be sufficient in amount and of such a character as to penetrate to the center and cause flowing throughout the mass. This flowing of the metal requires a certain amount of time and the requisite pressure should be maintained throughout a corresponding period. The hydraulic press fills these requirements exactly. The effect of the impact of a light hammer may be simply to draw out the surface metal and leave the center behind to such an extent as to cause cracks or even cavities in the metal and the use of such tools should be avoided. Under the slow motion of the press time is allowed for the molecules of the metal to move easily and the pressure is felt throughout the forging. The center being the hottest, and therefore softest, is squeezed out, and gives a convex shape to the end of the forging. During the forging process, in which there is a gradual reduction in diameter and increase in length, a great deal of work is put into the metal. In order that the

* From a paper by H. F. J. Porter, before the Engine Builders' Association at Pittsburgh.

metal should be worked at the proper temperature, it is necessary to reheat it a number of times, and every time the press descends upon the metal the latter is worked under conditions differing from those existing when the press descended upon it before, because it has cooled a little in the interval. As, therefore, when finished, no two parts of the forging have been treated the same, it is natural to suppose that it is full of forging strains. It is also apt to have cooling strains in it, due to the fact that it has been reheated from time to time in different places, as the forging process passes from one end of the piece to the other. These strains, if not relieved, are apt to develop in service, for constituting an initial load they may throw the forging out of true or even cause its complete failure if they happen to act in the same direction as the external working stress.

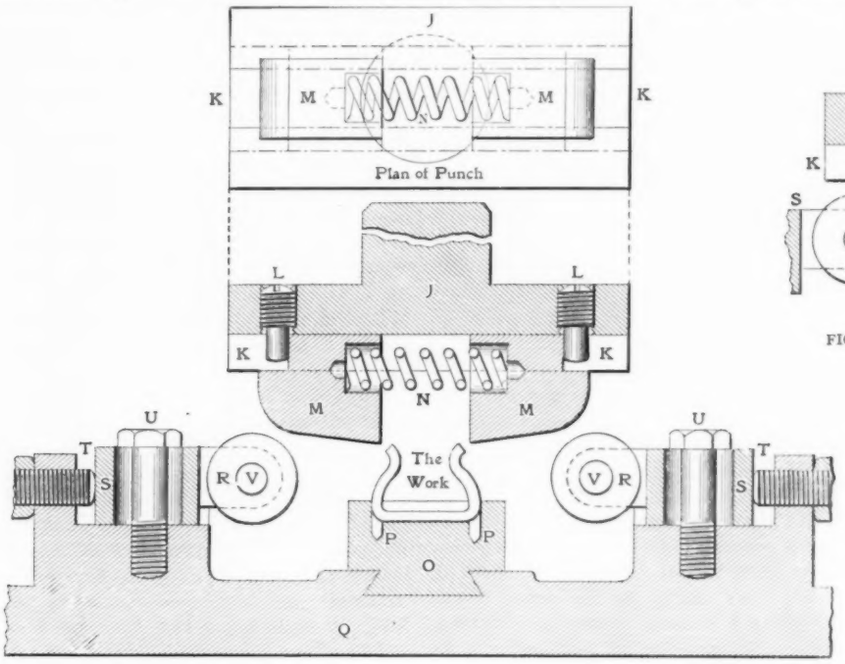


FIG. 8. PUNCH AND DIE FOR FINAL BENDING.

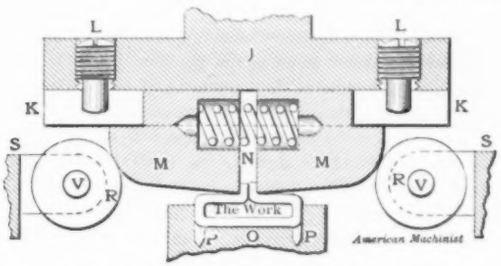


FIG. 9. SHOWING COMPLETION OF THE BEND.

To relieve these various strains, all forgings should be subjected to a final heat treatment called "annealing."

The rationale of this heat treatment is worthy of being considered carefully, as it was largely through its non-application that steel gained the reputation of being unreliable. If the rate of cooling of a steel ingot from the point of solidification to coldness is carefully noted it will be seen that the temperature will fall with regular retardation in equal divisions of time until between 1,300 and 1,200 degrees Fahr. a point (depending on the carbon content) is reached where it suddenly stops and for a time either remains stationary or perhaps rises for a short time, and then the same rate of cooling continues as before. This point, where the change of rate takes place, is called the "recalescent" point, and from chemical and physical tests it is known that a change in the structure of the steel occurs here. The fluid steel begins to crystallize at the point of solidification, and the slower the rate of cooling from there down the larger the crystals will be when the ingot is cold. At the point of recalescence,

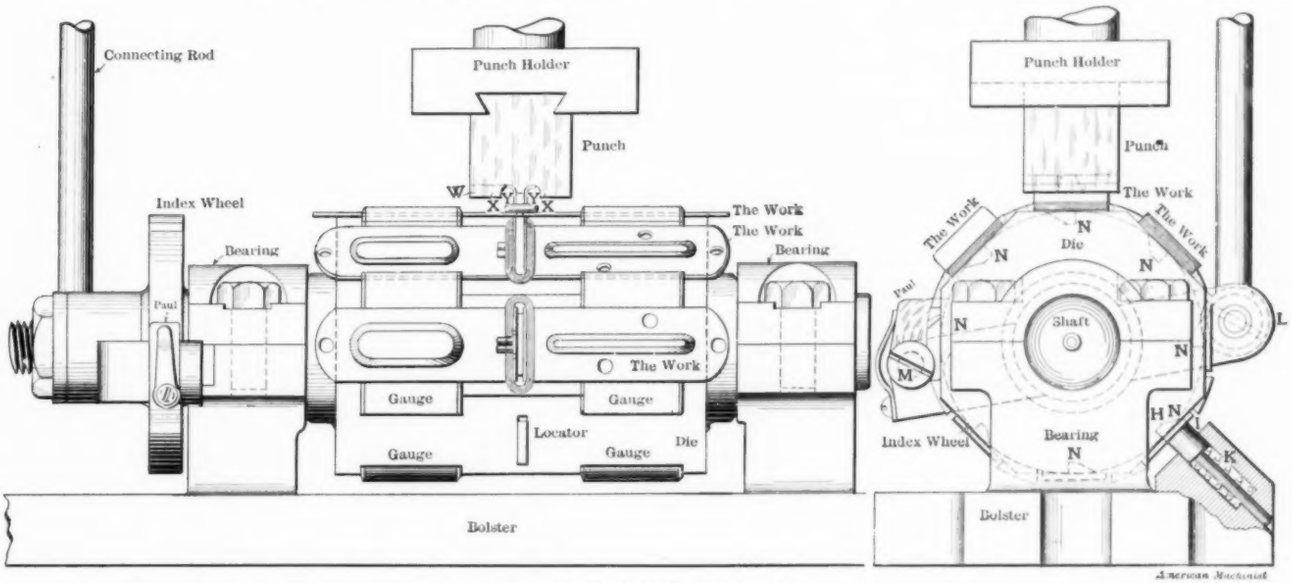


FIG. 10. SPECIAL OCTAGON DIE.

however, it would seem as if the crystallization, so to say, locks itself, for if, after the ingot has become cold, it is reheated to a temperature below this point, on again becoming cold it will be found that the crystallization is not affected, but if we reheat it a little above the recalescent point, when it is again cold the crystallization will be found to be much smaller than before. In fact, it is known that if steel is heated slightly above the recalescent point all previous crystallization is destroyed, and a fine amorphous condition is produced at that temperature. As soon as cooling begins again crystallization sets in, and continues until the ingot is cold. As, however, the time of cooling from the recalescent point is comparatively short, the resultant crystallization is correspondingly small. It can be readily understood that when heat treatment can completely change the internal condition of steel, it should bear an important part in the manufacture of forgings made of that metal.

Consider for a moment the changes which take place in the condition of the metal as it passes through the forging process. Beginning with the cold ingot which, having cooled slowly, is therefore composed of large crystals, it must be reheated to a forging temperature of from 1,800 to 2,000 degrees Fahr., thus passing through the recalescent point, destroying all crystallization and producing an amorphous condition. As soon as it is placed under the forging press it begins to cool, crystallization at once setting in; at the same time, however, the press begins to work upon it. The work of forging tends to check crystallization just as disturbing water which is below freezing point will delay the formation of ice crystals. The work of forging may or may not continue (depending upon the size and shape of the finished piece) until the temperature has fallen below the recalescent point, but during this time more or less crystallization has occurred, and has been disturbed and distorted. The work of forging has, moreover, proceeded from one end of the piece to the other, the part last worked upon having crystallized considerably before work was applied to it, so that the two ends may be entirely different as far as their internal condition is concerned.

If the forging were now considered to be finished it would be found to be full of pulls and strains about which nothing would be known except that they might amount to several thousand pounds to the square inch. The extent of these strains becomes evident when a forging, finished as above described, has a cut taken from it in a lathe or has a keyway cut on the surface. The strains in the fibers which are cut are relieved, and the piece invariably springs out of "true." Heating the forging to the proper annealing temperature will restore the internal structure to its normal state, when an entirely new crystallization is established, and the molecules of the metal are completely at rest. The smaller the crystals in a piece of steel, the stronger will be their adherence to each other, and if the forging after being reheated above the recalescent point is suddenly dropped into a bath of cold oil, no time being allowed during the cooling process for crystals to form, the amorphous condition of its structure at this temperature will be retained and its physical properties greatly increased. This character of heat treatment is called "oil tempering," and should be followed by a mild annealing heat treatment to relieve the metal of any hardening effect due to the cooling process.

In order to temper successfully a piece of steel, great care must be taken both in the process of reheating it and also in cooling it in the bath. In reheating it, the surface metal is apt to expand away from the center and thus cause cracks in the latter, as previously explained; and in dropping it into the cold bath the surface metal is apt to contract onto the center to such an extent as to cause cracks in the former. In order, therefore, to successfully temper a forging, it should be hollow. By taking out the center it can be reheated without danger of cracking, because the center metal is absent and the heat gets into the interior and expands both it and exterior together. Also in dropping it into the cold bath there is no solid center on which the metal is contracted, and in that way the danger of cracking during the cooling process is eliminated.

An annealed forging has its elastic limit somewhat reduced as compared to its tensile strength, but its ductility is increased very considerably, as shown by its contraction and elongation in test pieces. The elastic limit of an annealed forging is invariably less than one-half of the tensile strength. By "elastic limit" is not meant the point usually determined by the drop of the beam in an ordinary testing machine, but rather the carefully defined point obtained by an electric micrometer, which is from 2,000 to 10,000 pounds lower.

It is very evident that the twisting and other manipulation necessary in the forging of irregular shapes, such as solid forged crankshafts, will leave strains in the metal which, unless relieved by heat treatment as above referred to, will cause such failure. The great mortality of this character of forgings is in part due to the fact that they have not received such treatment, either through ignorance or otherwise.

All steel forgings should be finished with good sized fillets at all corners. In such forgings as connecting rods, special care should be taken to have the four corners of the eye in the head well rounded to resist the tendency to crack at these points should the cross-head or crank-pin heat up and bind in the brasses. In piston rods the taper at the ends should not start from a "set down" with a sharp angle.

A New Variable Speed Mechanism.

BY WALTER FERRIS.

On account of the necessity for exact adjustment of the speeds of the various parts of a paper machine, so that the sheet may pass from one to the other without being broken, builders of paper machinery were hard at work upon the speed-changing problem long before the machine-tool builders suspected that the step-pulley does not answer every purpose. The first device used in paper mills consisted in winding sheets of tarred paper or felt upon the pulleys to slightly change the diameters. Then came the expanding pulley, introduced by the Pusey & Jones Company, of Wilmington, Del., in which each arm carried a separate section of rim, and the arms were arranged to have a simultaneous radial movement, like the jaws of a universal chuck. This was so arranged that the size of pulley could be changed while running. This device answered well for low speeds, but with the great increase in speed during the past fifteen years, the irregularities of the rim made it impracticable, and tapered pulleys have come into universal use. A number of pairs of pulleys, of slight taper and from 24 to 36 inches diameter, are provided to adjust the speeds of the various sections of the machine, while the main line shaft, which carries the driving pulleys of these pairs, is itself driven by a large pair of cone pulleys, which are required in some cases to transmit as much as 150 horse-power. Such cones are about 48 inches and 72 inches diameter at the small and large ends, respectively, by 12 feet long, and the driver runs 200 or 250 revolutions per minute. The belt used is from 15 to 20 inches wide.

Of course, a great deal of trouble is experienced with these belts, which wear out in from three months to a year, according to circumstances. In the effort to deform the belt as little as possible in running it upon the cone surfaces, a narower belt is used than usual practice calls for, and this causes breakage.

The Moore & White Company, of Philadelphia, have recently invented a device which they call a cone pulley transformer, which seems to me to be the simplest and most "mechanical" of all the devices yet brought out for this purpose, and the performance of which should be watched by machine-tool users. If further experience confirms the results obtained so far, it should make a simple and durable variable speed countershaft.

The essential improvement consists in the use of a pair of endless belts, Fig. 1, which are composed of wooden lags, faced with leather on one side and connected by leather belting on the other side. One end of the lags is enough thicker than the other end to compensate for the taper of the cone on which they are to be used, and the side to which the connecting belt is riveted is high in the middle, like a

crowned pulley. Each "transformer" is large enough to loosely encircle its cone pulley at the large end.

When in use, as shown in Fig. 2, the transformers are placed on the cone pulleys with the thick ends of the lags toward the small ends of the cones, the leather covered faces of the lags against the pulley surfaces, and the connecting belts, which are riveted to the lags, away from the pulley surfaces. Then an ordinary belt, about 2 inches narrower than the transformers, is run upon the transformers exactly as upon a common pulley, and the belt receives no twisting strain or unequal stretch whatever.

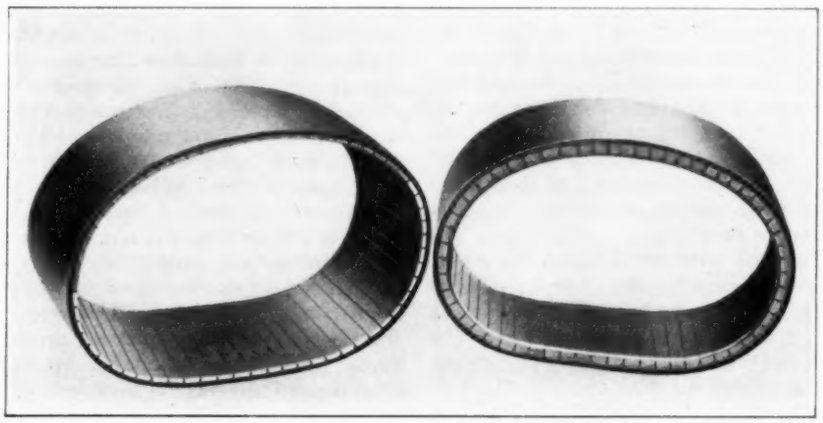


FIG. 1. ENDLESS BELT WITH WOOD LAGGING.

The manner of applying the shifters is also clearly shown in Fig. 2, which is made from a photograph taken while the driving cone was running at 210 revolutions per minute. The surfaces of two equal reversed cones are equidistant from end to end, and the screws *a a* for traversing the shifter are placed parallel to these surfaces, and not to the shafts. The cheek pieces *b b* are then extended close to the pulleys, and serve merely to guide the slack length of the transformers as they leave and return to their respective pulleys. No shifter is used upon the belt, as it follows the crowned surfaces of the transformers.

The photograph, Fig. 2, was taken from the cones driving a 96-inch (width) paper machine in the mill of Dill & Collins, Philadelphia. As the machine was running, the lagged construction of the transformers is not shown, and they appear continuous. The driving pulley is marked P_1, the driven pulley P_2, and the curves of the slack transformers as they leave the pulleys, pass through the shifters and return to the pulleys are clearly shown. These cone pulleys are 40 inches diameter at small ends, 50 inches at large ends, and 7 feet long. The shafts are 11 feet center to center. The driver runs 210 revolutions per minute, and a 12-inch double leather belt is used, transmitting about 75 horsepower. The installation is an old one, and the shafts are 1⅝ inches closer at one end than at the other. The transformers were applied about February 1, 1902, and I am informed by Mr. White that they are giving entire satisfaction, using a 12-inch belt instead of the 9-inch belt previously used. I have not seen this pair, but have seen the experimental pair running in the Moore & White shops. The latter pulleys are about 12 inches and 20 inches diameter at the ends, and 5 feet long.

Echoes From the Oil Country.

WHO IS THE LAZY MAN?

There seemed to be somewhat of an argument outside the shop where the men were resting through the noon hour; I was attracted by the sound and went out. I found it was an argument between Frank and George as to which was the lazier of the two. A mock trial was improvised; I was proclaimed the judge and given an empty nut box to sit upon.

Then said Frank: "I've been working here more than six years, and I have done more hard work than any other man that has worked here in that time. I used to break up all the pig iron and scrap and wheel it and the coke up to the 'cupalo,' mix the sand in the foundry, clean the castings and take them around the shop where the men wanted them, and load and unload everything that is hauled in or out. If anyone wants a lift Frank is called every time. If the blacksmith wants an extra helper, it is Frank that goes out. I just wish you had a fellow like George in my place for a few days and you'd all soon see if its a lazy man's job or not. I'm willing to let him try it if he has sand enough to." And Frank turned a broad grin over in George's direction.

"What have you to show that George is lazy?" I said.

"I don't think that needs any showing. We all *know* he is lazy. There never was any doubt of that. The only thing was that he said I was lazier than he. You see, he didn't deny being lazy; it wouldn't have been any use, we all know it too well, but he would like to make out other people are, too. Just look at that white collar this hot day. Just look at his soft hands. Just see him prance down here at 8 o'clock in the morning and trot home at 5 o'clock in the afternoon and never sweat a drop or lift a pound."

Here Frank rested his case amid applause from the men.

"I suppose I have a right to do some cross-questioning, haven't I?" said George.

I nodded.

"Frank, do you still break the pig iron with a sledge?"

"No; it's done with a drop, but I'd rather use the sledge than fuss with that drop."

"Where did the drop come from?" asked George.

"I guess the shop made it from that little sketch you gave them after you stood around one day while I broke up a lot of iron. I suppose you got so tired sitting on that stool you came out to rest. I mind you leaned up against the shed with your hands in your pockets and whistled, and you looked at your watch every minute or two." At this the men all laughed, and George joined in. He was getting a view of himself from a new standpoint.

"You don't wheel the iron up any more, do you?" asked George when the laugh had quieted down.

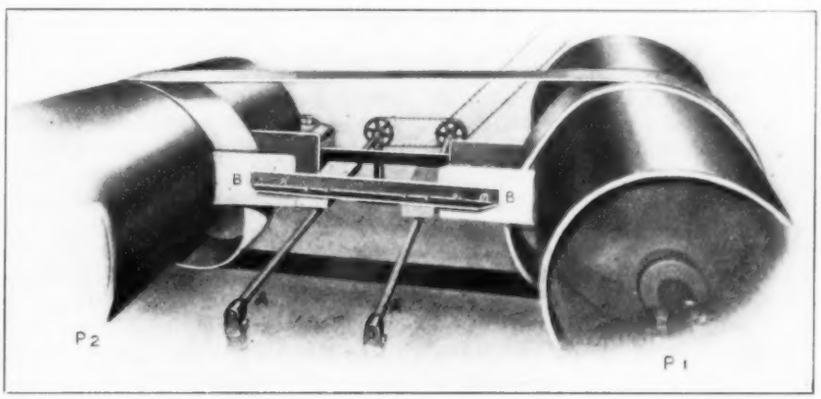


FIG. 2. COMPLETE VARIABLE SPEED MECHANISM.

"No, that was another of them little tricks of yours. After you loafed around for two or three days you just made a little sketch of an elevator to fit in there to put up the iron and coke. Oh, you're smart all right enough. If you didn't do something like that once in a while you would have to get out and work for a living like the rest of us. Now you can set up there and make a few pictures for the men to work to." And Frank looked around to meet the approval of the audience.

"You seem to have me and my job down pretty fine," said George, with a good-humored laugh; "why didn't you get a job like it?"

This seemed to tickle the crowd. They evidently saw something very funny in the idea of Frank in the place George was filling. Frank looked around at his laughing comrades rather bewildered, as though he was looking for some reason that would answer the question. Finally he said:

"I don't know but I could a had one long ago if I'd have set around and just thought instead of getting at it and working and earning a living. You see, I'm not *lazy* enough for that kind of a job, though it does seem as if the lazy fellows somehow got the best of it—around here, anyhow."

"Wasn't you put in charge of the laborers once for a few days?"

"Yes."

"Why didn't you keep that job?"

"That's all right to talk about. You wouldn't like to have to look after a lot of fellows without any heads. Them fellows didn't know enough to rub the sand off a casting. A man would go crazy in two weeks' time trying to look after a lot of heathen like them." The recollection seemed to awaken painful memories in Frank's mind as he continued: "Between having the boss from the machine shop after me and keeping them from chipping off lugs and leaving on gates, and breaking the light castings and leaving the core sand inside, I had a dog's life, to say nothing about trying to get a decent day's work out of some of them. Them fellows were enough to drive a man crazy. I would keep on the lookout all day, wondering all the time what dumb thing some of them would do next, and at night I would be so tired I could hardly crawl. I don't see how I could have got so tired when I hadn't done a thing all day except walk around and talk and get talked at. I don't want any more of them kind of jobs. Twenty-five cents a day isn't any temptation to me. Some of you fellows that were born lazy are welcome to my share of it.

This ended the cross-questioning and George then gave his side of the matter:

"I'm a good bit like Frank in one way," he said, "I don't think there is very much to say except on one side, and Frank has told that pretty well." Frank looked around triumphantly with a well-satisfied look in his face. "From what I can understand, he thinks bossing is too hard because *thinking makes him tired,* so I suppose he has worked hard with his body because he found that easier than working with his mind. That is an old trick with lazy people." The look on Frank's face had been changing somewhat. "It hardly seems reasonable that he would let others take all the better paying jobs if drawing the salary and spending it was the hardest part of them. According to his own statement, it pretty near made a wreck of him when he did do a little thinking for a few days." Frank had taken off his hat and was scratching his head in a thoughtful way. "I'd like to ask Charley if he had a 'soft snap' when he was boss over at the heater works?"

"Not on your life I didn't. I got as thin as a crow," replied Charley. "How was it with you, Jim, when you had a whirl at it up at the big shops? Did thinking make you tired?" turning to another man sitting near.

"Tired? I should say I did get tired. I used to think a boss had an easy job; I don't any more. I would get so tired it would wake me up in the night. It seems strange that a man will get so tired all over just thinking, but it's lots worse than getting tired working, and harder to get rested. You see, you have to do the worrying for every man you have working for you, and plan ways to keep them from making mistakes and ways to fix up things when they do make them. And the worst of it is lots of the fellows don't care if they do things as you want them or not, and you can't watch everything all of the men do all of the time. Then the office always wants the job first that you haven't started or else the one you haven't the stuff for. If anyone can't get tired, just let him tackle the job I had for awhile and see." Jim had evidently taken several degrees in the secret work of bossing.

"I think I have enough evidence in," said George. "For myself, I will say I never have any trouble about not getting tired enough, and I think most of those who have been at such work are the same way. All I object to is Frank's thinking I am lazy and don't work because I don't break pig iron, and I am afraid there are a good many like Frank around the shop that think the same way. I think they should all apologize for thinking so, and own up that they are the real lazy fellows. Frank, there, should be past master among them, as he is just about where he started six years ago. Mr. Judge, I rest my case."

"Hey, Frank, how do you feel now?" "Be careful how you use your brains on that sand heap this afternoon: you might have to put a plaster on it to-morrow." "Just think where you could have been." "Cheer up, old man; a man can't use what he hasn't got." "The boss ought to be glad you didn't start thinking when you were young." These and a lot more greeted Frank as George stopped.

Just then the whistle blew and the men made a rush for the shop, thus relieving me of the trouble of giving a decision.

W. OSBORNE.

Letters From Practical Men.

Postage on Drawings.

Editor American Machinist:

I'd like to have you tell me what rate of postage mechanical drawings should pay. It has come to my notice that the same package often pays a very different rate at different times. For instance, not long ago you mailed me a tube of drawings that (I am not just sure about the figures) bore about 12 cents postage, and which cost me 20 odd cents to remail to you. I paid full letter rate, and a mild remonstrance on my part served only to show me that the stamp clerk considered himself well versed in postal law. W. S. R.

[Drawings or plans containing written words, letters or figures, indicating size, price, dimensions, etc., are first-class matter, the rate of postage on which is 1 cent per ounce. Blueprints are third-class matter, the rate of postage on which is 2 cents for each 2 ounces. It is proper to remind our contributors that blueprints are more convenient for our use than any other style of drawing or reproduction.—Ed.]

Some Little Things That Count.

Editor American Machinist:

Sermonizing isn't in my line, but I've run across one or two things lately which emphasize the necessity of looking after the little things in a machine shop and elsewhere. First of all it was in the drafting room, where the designer neglected to make the steam port so that the steam would flow all around the valve and equalize the pressure. This little thing forced the valve against one side and the valve began to cut, as any well-regulated valve would, in spite of Dixon's graphite or anything else.

To remedy this the valve was taken out to be planed off a little in the center, so as to hold the lubricant better. After careful injunction not to drill through, but just enough to let a shaper tool start in the cut, the valve was given to a machinist who tried to do as he was told. But one hole broke through into the core in spite of him, and, like most of us, he forgot to say anything about it—didn't think it would do any harm, and so didn't plug it up.

He forgot all about the core sand that was inside, and that it is first cousin to carborundum, and after planing off a "thirty-second" the valve went back in its place. Everybody was satisfied that this was the remedy for the trouble, but it didn't take long for the aforesaid core sand to find its way out of the one hole, and the result can be imagined. We all know how nice a bearing cast iron makes at times, and also how it seems to be possessed of fiends when anything gets dry or

core sand gets at work. The iron rolled up in chunks and ploughed grooves in both valve and seat and, worst of all, the engine was rejected on account of it.

Two little things, the design of the port and the hole going clear through, cost the builder both dollars and reputation.

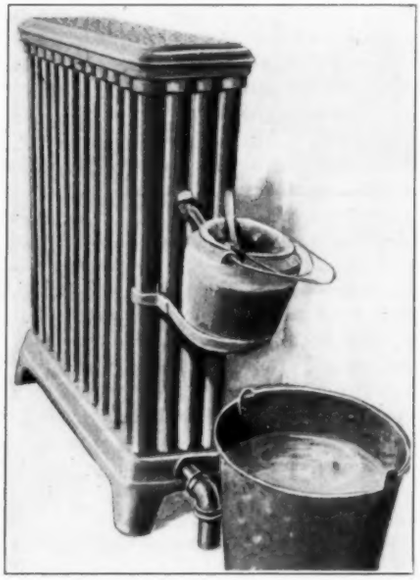
The next question is how these things can be remedied? One says "discharge the man who does it" and another argues "pay better wages and get better men." Which is right, or is either a remedy?

Take the case of a crane operator commonly called "unskilled labor." He probably has a greater capacity for damage to both life and property than anyone except a locomotive engineer. An error of judgment, a momentary loss of nerve or self-control may send tons of molten metal on a mission of death or damage beyond repair some expensive piece of machinery he may be handling. Is it a question of wages so much as of individuality, or will discharging remedy such matters? In any case the employer must stand the financial loss and the wage question returns to the law of supply and demand where it always finds level. How can these expensive mistakes be avoided, and justice be done to all concerned? R. H. JACKSON.

Heating a Glue-Pot.

Editor American Machinist:

I send you a photograph showing how a glue-pot was heated in a little shop for a time. The bracket for supporting the glue-pot was made of band iron bent around as shown and bolted with a stove



HEATING A GLUE POT.

bolt. A hole was drilled in the water part of the glue-pot near the top and a bent piece of pipe was inserted going nearly to the bottom. The top of the pipe was thrust over the vent cock in the radiator. The pail below the glue-pot caught the water when it overflowed.

A. G. CHILDREN.

Nails in Pattern Work.

Editor American Machinist:

Nails are not a very large subject to write about, but the use and misuse of them by patternmakers is often interesting. Nails that have been driven below the surface and which it is necessary to draw, can often be driven through the piece and then punched back until the heads project; then it is an easy matter to get them with a claw hammer.

A nail-set driven down alongside the nail and used as a lever under the head will often start it enough to be drawn with a hammer. I use a little tool for this purpose with the end shaped like a pinch bar. Small nails, one inch and under, can often be *pushed* into small, delicate work with less danger of breaking it than if driven with a hammer.

The trick that many patternmakers have of driving nails through a glue joint to hold it together and leaving the heads projecting reminds me of the apprentice who put a clamp on a joint and forgot to screw it and then wondered why his glue joint didn't hold. If a nail is expected to hold two pieces together, it must be driven to the head.

I once had a machinist come in asking for a couple of small nails. I fished him out a couple of ⅜ inch, No. 22; the smallness of them rather surprised him. If nails are used for binding two pieces together and are to be withdrawn after the glue has set, it is wise to provide some extra stock on the work, as drawing the nails mars the work; or the nail can be driven through a small additional piece laid on top of the work. On splitting this off the nail a claw hammer will go on.

By bending a nail at right angles near the head and driving it alongside a delicate rib or similar piece to be glued on, it will serve as a clamp in places that cannot be reached otherwise.

Uneven pieces or parts that have much draft can be leveled for band sawing by driving nails in the under side of them so that the heads will bear on the saw table to prevent rocking. This is much quicker and just as good as blocking under the entire piece. It is an easy matter to drive in or draw the nails after the sawing is done.

I have often driven a 3-inch nail through a rib ¼ inch by first drilling a hole to remove the stock so that the nail could occupy its space. I often drive a nail through a delicate piece to prevent the molder splitting it by first drilling a hole for the nail.

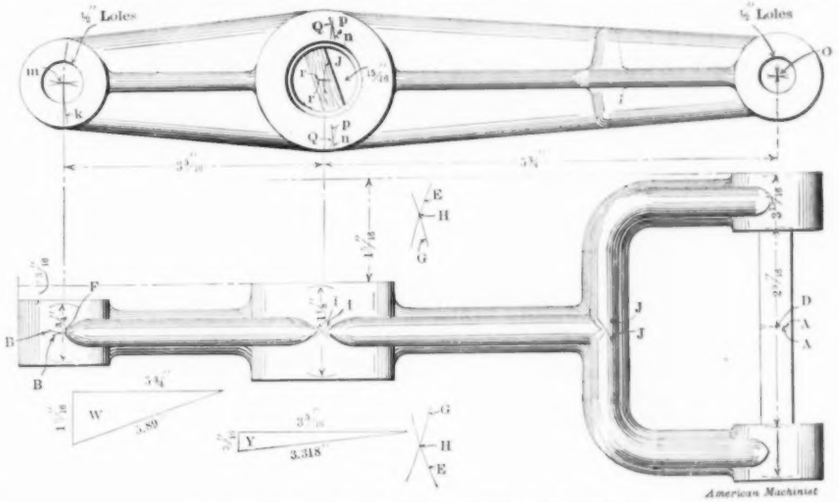
Many uses of nails besides these will often suggest themselves.

J. L. GARD.

Laying Out a Lever for Planing and Drilling.

Editor American Machinist:

The drawing shows a casting of a forked lever which it is desirable to lay out before planing or drilling. The middle hole is cored, while the end hubs are cast solid.



LAYING OUT A LEVER FOR PLANING AND DRILLING.

I would go at it in this way. Put sticks in as shown and strike arcs *A A* on the cross-stick also on the other end arcs *B B*; these arcs are all struck from the outside of the casting. Place the lever on a platen or surface plate, paint the casting with whiting, also the table where we will strike arcs, and when dry lay the lever down. Care should be taken not to move the lever after beginning, as it would displace the center line. From point *D* strike arcs *E E* on the table, and from point *F* strike arcs *G G* cutting arcs *E E* at *H H*. From *H H* strike arcs *I I* and *J J* on the casting, which causes all four points to come in line. Prick-punch these center lines for use on the planer and drill, and strike the arcs shown for finishing to on the planer or milling machine.

The piece being planed to the marks, we then lay it out for the drills, it being necessary to have the centers of the three holes in line as per the upper figure. Referring to the dimensions given in the figure, and following the practice described in my article on "Laying Out Circles on Different Planes," we assume 5¾ inches as one side of a rectangle and 1 5-16 inches as the

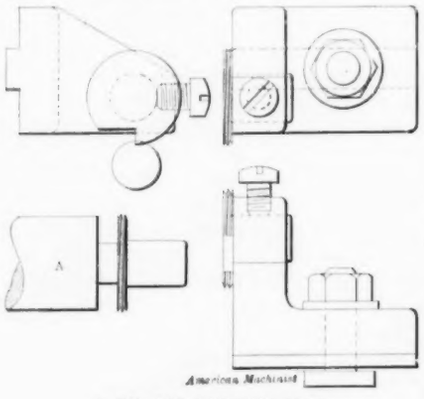
other side, thus obtaining (see *W*) the diagonal 3.318 inches. With the dividers set to this measure we strike arc *J* from point *o*. Then with the dividers set to 3.318 inches (see *Y*) from arc *J* we strike arc *K*. This gives us the correct distances for the holes. Open the dividers, and from point *o* strike arc *p p*, and from *m* strike arc *n n* cutting *p p* at *q q*. From these points strike arcs *r r*, which locate the center of the middle hole and this brings the holes in line. C. W. PUTNAM.

A Thread Cutting Tool.

Editor American Machinist:

The accompanying figures show a thread tool that has some good features. It was used on a small bench lathe with rear chasing arm, but there is nothing to prevent its use on any lathe in place of the tool-post. This particular tool was made to thread brass screws 0.370 inch diameter by 1½ inches long, 36 pitch, which had to fit uniformly the whole length. The screws were made from ⅜-inch brass rod and the tool was fed in until the right size was reached, thus saving a separate operation of turning and leaving no wire-edge or burr, as with a single cutting point.

The forming tool was turned up on the end of a bar *A* in a chuck to twice the diameter of the screw and threaded 18 pitch, double, left hand, to give the required angle and shape of thread. The center of the tool-holder was made to come slightly below the center of the lathe for clearance, but this changes the shape of the thread so slightly as to be negligible, and in this case the tap was cut with the same tool, which made the shapes correspond. This tool will cut up to a shoulder, is easily set, can be continually reground on the face, and when reset will



A THREAD CUTTING TOOL.

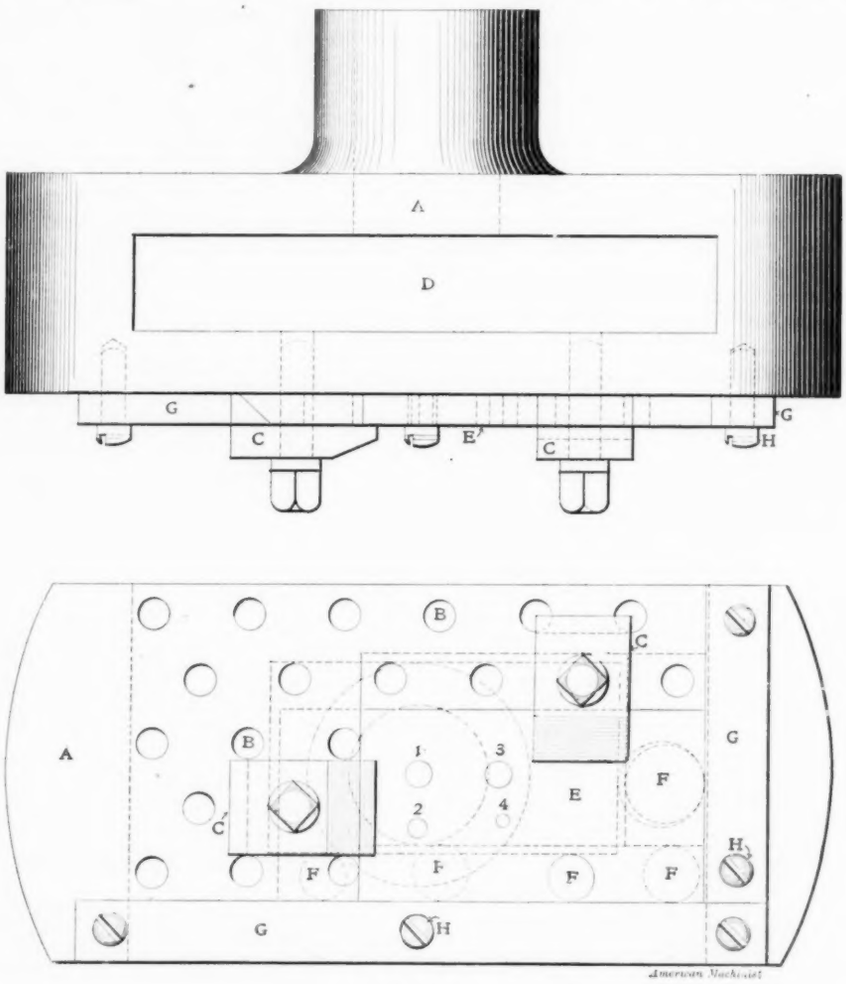
come to the same place; also the screws being cut can be calipered over the threads with a micrometer both for size and parallelism. P. A. G.

The Box Face-Plate.

Editor American Machinist:

The accompanying sketch illustrates what is called a box face-plate, which is not in general use throughout this part of the country. One would naturally think that many devices of this kind, which are easily made and save quite a good deal of time, would be more in general use. These box plates are much more handy than regular face-plates for quite a good deal of work, especially on jigs and dies.

A represents the face-plate which screws on the spindle of the lathe in the usual



A BOX FACE-PLATE.

way. Its face is filled with ¼-inch tapped holes *B*, evenly divided and at a reasonable distance apart to allow for moving the clamps *C* in different positions as the work varies in size and position. When the work is too large to admit of using clamps *C*, it can be held with an ordinary pair of parallel clamps, one leg or side of which goes into the opening *D*, while the other is on the work, clamping it to the plate. Suppose we have a piece *E*, in which we wish to put any number of holes at any required distance from each other numbered 1, 2, 3 and 4. We locate the piece as near as we can see for hole No. 1, then indicate it up, and, when true, bore it out; but before taking it off we take a common flat square without a back and clamp it to the plate against the piece, then loosen up the piece and move it for hole No. 2, having previously made the buttons *F*, shown by the dotted lines, or a parallel the required size we wish to have the holes apart may be used, put button or parallel between the square and the work and clamp in place as before, then remove the square and finish the hole, repeating as many times as desired in either direction. In place of the square we can use the pieces *G* which are located the proper distance from hole No. 1 and screwed to the face-plate by the screws *H*, which make them permanent. They can be left in place until the work is completed, as here shown, using the buttons or parallels as before, buttons being preferable as they are much more quickly and easily made.

M. W. LEECH.

Machining Side Rods.

Editor American Machinist:

To turn out a neat lot of side rods in the slotter is a job demanding skill and the close attention of the workman. It is highly desirable to do this work by method, instead of finishing the rods just as they happen to fall on the table, as is often done in this day of rush.

Fig. 1 shows a side rod and Fig. 2 an end of the rod, the letters indicating the surfaces to be machined in the slotter. A 12-inch machine is best for this work. Taking two rods that have been planed on

the flats, set them on the circular table, as shown in Fig. 1, and start the cut, always running the feeds in the direction indicated by the arrows. When the tool has reached the point *M* throw out the circular feed and use the lower feed, causing

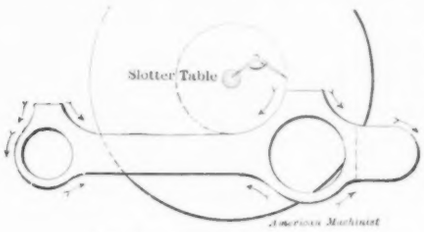
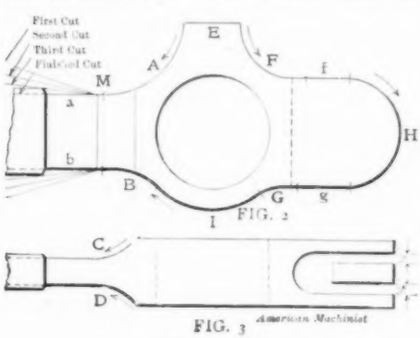


FIG. 1. SETTING THE ROD.

the tool to cut on a line outside of the desired tangent. Mark the upper table in this position. In the succeeding cuts the tool runs closer and can easily be made to work on the desired line after a few cuts have been taken. Finish in this way at *A a*, *B b*, *D d* and *G g*. After finishing at *a*, the table is clamped and face *E* is machined square with the rod. The cuts *H* and *I* are made after finishing at *f* and *g*. Both ends of the rods are machined in this manner and then they are turned up on edge and finished at *C* and *D*, Fig. 3. In these operations do not take too heavy a feed or you will "saw-tooth" the bottom of the rod, making a sorry looking piece of work.

A bright young fellow who was machining some side rods one day was running a roughing cut near the line on the extreme end of the circular portion. He was desirous of doing a fine job—which he could easily have done had he been left alone—but the foreman, a late acquisition in that shop, came along and, noticing the slight feed, yelled out, so that all could hear, "Put on more feed there!" The young fellow, without a word, stepped around to the side and doubled the feed, and the foreman walked away. Horrible-looking saw teeth appeared around the lower edge of the job, and when the work reached the erectors there was a noise, and an



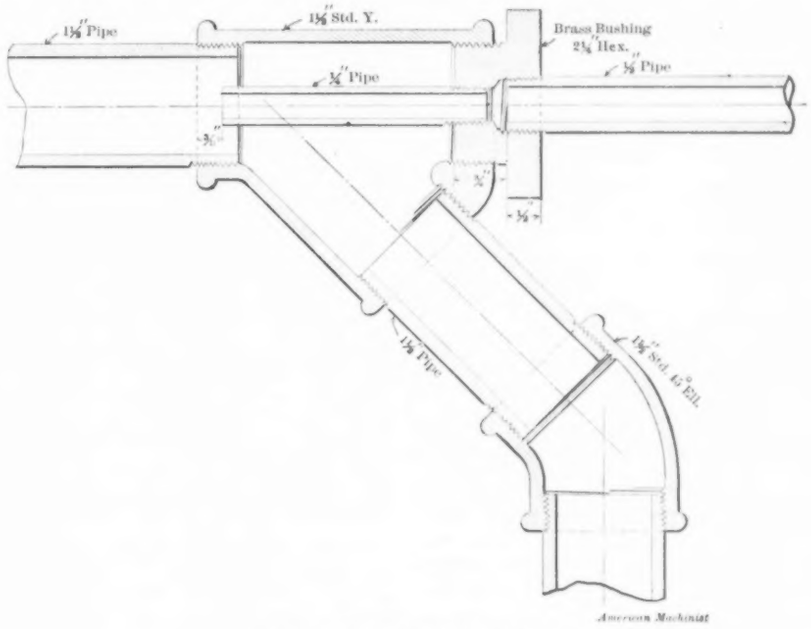
END OF ROD.

effort was made to saddle the blame for the beastly job on to that fellow, but he would not have it so, claiming that he followed orders.

The rods are sometimes necked as shown and then taken to the planer or milling machine, where the middle section is finished.

The cutting out of the fork end is next in order, and some shops still use costly and old-fashioned methods of doing this job. In one large shop was noticed the plan of running in a ⅝-inch parting tool, as in Fig. 3, and truing up the sides of several cuts. The tool ran under one day and spoiled the job. Why were not these people brilliant enough to use the tool shown in Fig. 2, page 1145, Vol. 24? This tool is a money maker; it walks right into the work, gives no trouble, and finishes the fork complete in two cuts. There is no necessity to drill for relief, and a much better job is made (and in one-half the time) than by the other method. It is needless to say these people never read the AMERICAN MACHINIST.

FRANK RATTEK.



A HOME-MADE STEAM SIPHON.

A Home-Made Steam Siphon.

Editor American Machinist:

Having read your paper for the past two years, I have noted a great many valuable suggestions from practical men.

I wish to add to this list a steam siphon, made from standard pipe fittings, which I have found equal to the best which is on the market to-day. The enclosed print gives all details and may prove of some value to some of the many readers of the AMERICAN MACHINIST. The siphon shown will lift 3,600 gallons of water per hour from a depth of 8 feet when supplied with steam at 85 pounds pressure. X. Y. Z.

Fillets and Rounds on Patterns.

Editor American Machinist:

Quite often have I read the discussions on fillets and rounds on patterns, and I am in step with the army of patternmakers who use them and praise them. It has been my experience that considerable time is saved in making patterns where there is at hand a necessary supply of the various sizes of manufactured wood and leather fillets. Having considerable to do with patterns for special machinery, I know that it is a great saving of time, instead of working certain patterns out of the solid, to feel that you can saw the necessary taper on the bandsaw, or the many irregular shapes met with, and then take a bit of leather fillet, apply glue to it, and run it in its place with a very handy tool, a piece of steel rod half round on the end. We have a complete set of these for our various sizes of leather fillet, running from 1-16 inch to the ½-inch size. We use great quantities of the sizes up to ¼ inch, and every corner has a fillet for strength, estimating as we do that it adds 30 per cent. on our special class of machinery patterns, and where each pattern is made for a casting that will have just enough strength and no more for its greatest emergency, this is important.

On all straight parts over 8 inches long we use a stock wood fillet of which we keep a good supply on hand. I have only one complaint to make about these and that is, that the wood fillet makers don't make a smaller size than ¼ inch. We have made inquiries about a 3-16 and ⅛-inch fillet and have received the reply that they found not enough demand for anything under ¼ inch. Machined wood fillet is a great time-saver over the old way of working them by hand, and certainly less expensive, while leather fillet is simply grand.

You will also find that in all corners that are square a 1-16 inch leather fillet will save the molder lots of time in drawing the pattern, as it will not tear up the sand at all, if it is applied correctly and

then sponged with warm water to clean off the glue that squeezes out. When a corner is patched up in a mold it is almost always sure to show a blister or scab when the casting is cleaned off. I believe that a part of the equipment of the pattern shop should be a good supply of wood and leather fillets; and as to rounds on a pattern, wherever practicable they add beauty to the pattern or to the machine when completed. Be it ever so little, if the case will admit, take off enough to make a neat round. We have on machines that we are turning out at the present time castings or parts that are beautiful for systematic rounding on the edges, or that have their shapes run into the ellipsoids, and in many instances to get these it has taken great care and time for our best men to get the coreboxes to give correct castings without ugly seams or joints.

STEVOE.

Locating a Stop Pin—Novel Steady Rest for Grinding.

Editor American Machinist:

These simple devices are, as the fellow says, "real handy," and as I have seen good toolmakers that were unfamiliar with them, hope they may be new to others. Fig. 1 shows a method of locating stop-pins accurately that I believe to be mine, as I have never seen it used by anyone else; but, as "there is nothing new under the sun," it may not be.

Not long ago I had a set of forming cutters to make for milling a curve something like *a*, Fig. 1. These had to be very close so that the product when gaged would shut out daylight. To locate the blank on the mill jaw the cutter was first run through the jaw. The model was then clamped on and the hole transferred and a stud accurately ground all over driven in place. I then made a bushing the outside diameter of which was equal to

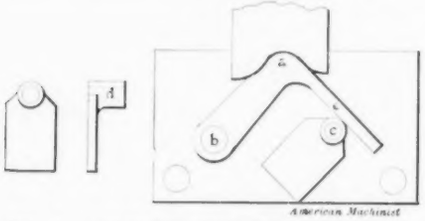


FIG. 2. LOCATING STOP-PINS IN VISE-JAW.

the pin to be used at *e* and clamped it upright on a perfectly flat plate. Then I clamped the piece of steel in the shape shown at *d*, soldered bushing and plate together and clamped the bushing on the jaw in close contact with the blank *e*. All that was necessary to complete the job was to transfer the hole through the bushing, enlarge with a counterbore with a close-fitting pilot, and drive in a hardened and ground pin of the same diameter as the bushing. I have found this device very useful on a great many jobs of the same character.

Fig. 2 shows an improved steady-rest for grinding small bushings for drill jigs in the bench lathe. The bushings are first turned and reamed from two to three thousandths smaller than the drill that is to run in them, then cupped, hardened and lapped to size. Then a hardened piece of drill rod to be used for an arbor

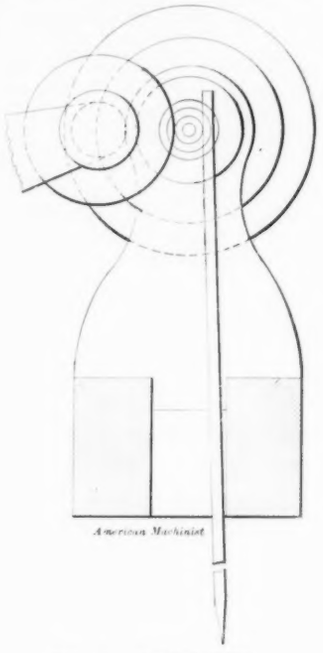


FIG. 2. STEADY-REST.

is held in the spring collet of the bench lathe and ground a wringing fit with the fingers for the bushing. The object in this method is that they may be absolutely true and also that the slide grinder may be used without interfering with the tailstock. Before starting to grind the arbor, however, a piece of drill rod is passed through the opening in the bed of the lathe, driven into the bench and sprung in such a manner as to exert a gentle pressure on the opposite side from the wheel. This prevents the chattering and jumping of the wheel which would otherwise occur. When the arbor is ground to size the bushings are wrung on and ground, using the steady-rest as before.

W. E. CALLAGHAN,
Dayton, Ohio. N. C. R. Co.

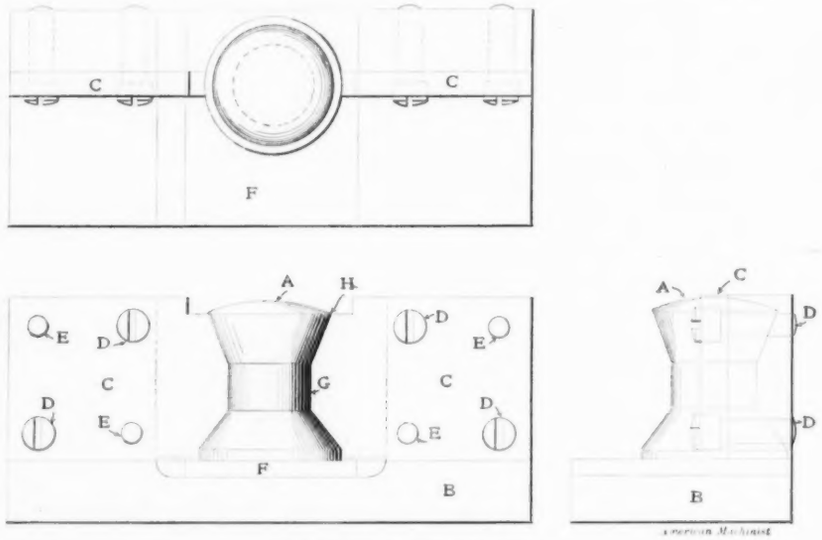
Gage for an Accurately Made Button.

Editor American Machinist:

The accompanying sketch illustrates one of many styles of gages, and is for gaging the button *A*, which is made with a great deal of care on the screw machine, the angles, hight, diameters and curve on the top being just as near perfection as is possible to get them without grinding. The center part marked *G* is not so accurately made, being made slightly small and not intended to fit the gage. The buttons are made with forming tools, which in profile are exact duplicates of the gage, which is for reference more than general use. There are other gages used in setting up the machine and in keeping the tools in shape. The buttons have to be machined so accurately that they will show a good bearing on the angles and on the bottom at *F*, when put into this gage.

The body *B* is in the form of a small angle plate, and to it the gage plates *C* are fastened, these plates forming the gage for the angles, and the hight from the bottom to the point *H* and to the top of the curve by a straight-edge laid across the top of the plates *C*, as a thousandth there is not important.

The plates *C* are hardened, ground and lapped and fastened to *B* by the screws *D* and dowels *E*. When the button is in



AN ACCURATE BUTTON GAGE.

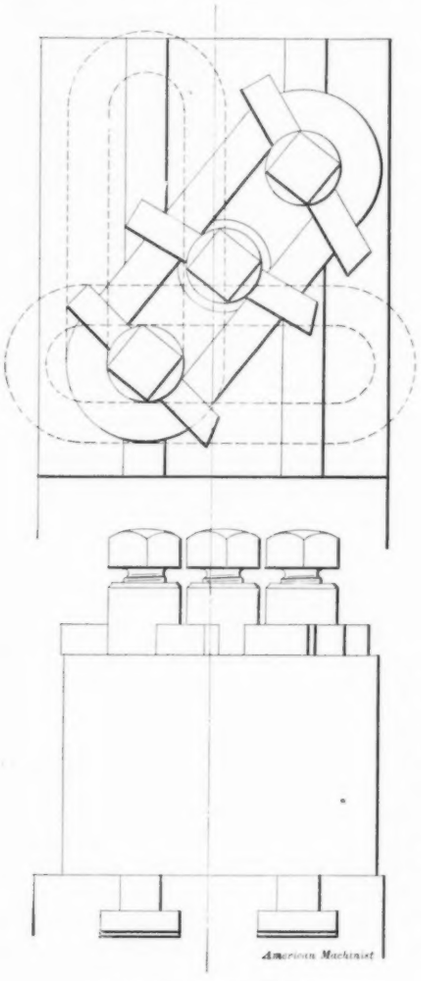
place, the piece *F*, which is also hardened, ground and lapped, should fit nicely between the button and the plate *B*. Generally the piece *F* is put in place first, allowing the button to be slid into the gage without cramping, after which the piece *F* is moved back and forth to get the feeling.

M. W. LEECH.

A Multiple Tool Block for the Turret Lathe.

Editor American Machinist:

The engraving illustrates a tool block for a screw machine which can be used to advantage on many different jobs. There are two on the machine, the rear one being 3/8 inch higher than the front one. Two of the tool posts in each block secure it to the machine, while the third may be placed anywhere in the slot. They are in use on a machine which is used principally to fill in when another machine breaks down or gets behind, so we have had good opportunities to try it in a great many different positions, and we have found it a good general tool. The dotted lines indicate the range of its adjustment.



A MULTIPLE TOOL BLOCK.

ROGER HAINES.

A Cutting-off Tool for the Hand Lathe.

Editor American Machinist:

I walked by a little device the other day that I think is a pretty good proposition—a hand parting tool for use on the speed lathe especially. It was designed by W. S. Davis for cutting off numerous small punches from Stubb's wire.

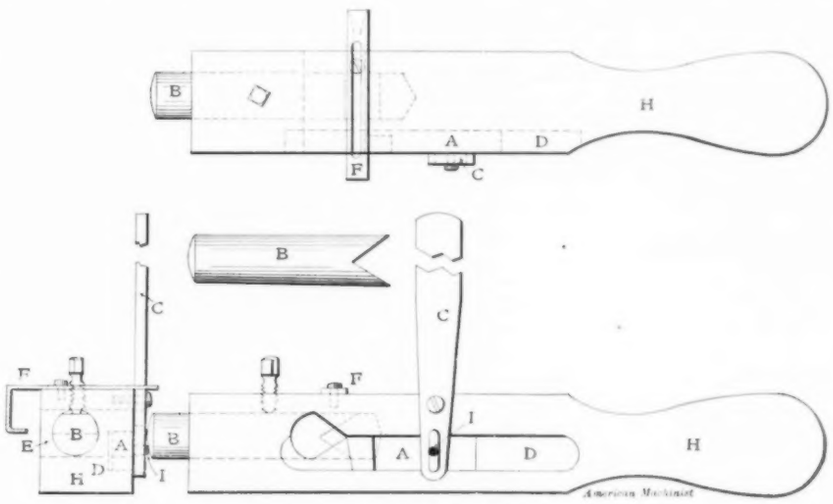
I have added an adjustable gage *F* and a movable V-piece *B* to make it adaptable to the different sizes of wire to be cut. *A* is a small parting tool with a pin at *I* and fitted to move freely in the milled slot *D*. It is apparent that to accommodate different sizes of wire *B* must be moved in or out. The tool is manipulated by the hand lever *C*. Stock 4 is of machinery steel.

Toledo, Ohio. CARROLL ASHLEY.

A Steel Hardening Trick.

Editor American Machinist:

It is astonishing what little reliable information can be found about hardening steel. It seems to be a topic upon which writers can say little that can be relied upon. And with good reason, for it is impossible, owing to the great variety of steels and shapes of articles, to give anything like reliable information. My own experience leads me to believe that the best way to insure success is to test all steel that comes into the shop and find out its particular nature. It is better to spend a few shillings at first than to lose pounds afterwards, but some bosses can't see it, and will watch a man spend a week turning and finishing an expensive job, and then grumble at his carelessness if it cracks in hardening, rather than allow him to spend a few hours, or perhaps a few minutes, experimenting beforehand.



PORTABLE HAND PARTING TOOL.

Another important part is the selection of a good man; too much care cannot be taken on this point. I should prefer a man with ten or fifteen years' experience to back him up, rather than a young bustling chap with heaps of technical knowledge. Nowadays it is difficult for a man about fifty to get a decent job, just the time when his services should be in demand.

I was at a place some twenty years back where great difficulty was experienced in hardening a certain type of cutter. Try? Why, I should think they tried all the mixtures under the sun; but crack they would, till one day an old chap, a fitter, one of the good old sort, asked the boss o let him have a try at it. The news soon spread that old Jim was going to have a "go" at that cutter. He was soon surrounded by some of the fellows who had previously failed and questioned as to his way of hardening. When a nice cherry red was reached, he carefully and with a mysterious look took from his pocket a paper containing a whitish-looking powder, which he sprinkled over the cutter. Taking it from the fire he quickly dipped it straight in the water. We were all surprised to see it come out uncracked. That cutter lasted as long as those hardened by the other chaps. From that day his fame as a hardener was established. He was often questioned as to his method of preparing that magic powder, but all to no purpose, till one day, which was my last at that place, I went to him to say goodby. The old chap had taken a fancy to me, because I had often obliged him, boiling tea and such like, and I could see that he wanted to do something in return now that I was leaving. So, thought I, now's my chance to find out how to make that famous powder. "Jim," I said, "you might, as a favor, tell me how you make your hardening powder." "Look here, my lad," said the old chap, "that powder's nothing to do with it; it's only a blind. Just come along with me and I'll show you." Taking one of the cutters with which we had had so much trouble, one of the hollow mill type, he proceeded to demonstrate. After heating it to a nice cherry red he said, "Now watch me. Now, instead of dipping it in the water with the hole downwards, I dip it with the hole up, which allows the steam to escape and in turn allows the water to enter, otherwise the water, being prevented by the steam from entering, would keep the inner walls soft and would also have a tendency to crack," which they did. I always think of old Jim now when I'm hardening hollow mills.

CHERRY RED.

Birmingham, England.

A Counterbore—A Paper Shrink Gage—A Micrometer Clamp for the Milling Machine.

Editor American Machinist:

I enclose sketches of three tools which I have seen in different shops and which will, I think, interest your readers.

Fig. 1 shows a counterbore which is cheaply made and in which one shank serves for several sizes. The slots in shank *a* and pilot *b* are open-ended, and hence cheaply made by milling. The cutter is clamped by the nut *c*, there being no wedge behind the cutter, the driving of which always forces the cutters to one side and produces unsatisfactory results.

Fig. 2 shows a shrink gage in which paper is used to determine the allowance for shrinkage. The thickness of paper may be determined by the micrometer, or if common newspaper is assumed to be .003 inch thick, the result will be approximately correct.

The body *a* has a hole, six slots *b* and a taper thread at each end. Several hardened and ground rods *c* are provided of

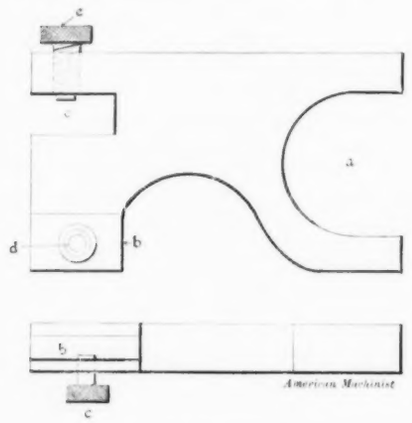


FIG. 3. MICROMETER CLAMP.

different lengths, and a plunger *d* with an adjustment screw at the outer end, the inner end being hardened. Rod *c* and plunger *d* are gripped in position by the binding nuts *e e*. A hardened plug *f* is inserted in the body *a*. To use the gage, place the required amount of paper between *d* and *f*, push *d* down and grip it by tightening the lock nut. Adjust the gage to the calipered size of the shaft and then remove the paper. Bring *d* and *f* into contact and tighten the lock nut as before.

Fig. 3 is a micrometer clamp for squaring or alining a vise or piece of work on the milling machine. The clamp is open-ended at *a* to permit its being placed between the collars on the cutter arbor without removing them or the nut. Two slots *b* and *c* are of suitable size for the micrometer yoke, and screws *d* and *e* are for gripping it to the clamp. These screws should be of brass, to prevent damage to the micrometer. By placing the micrometer in one or other slot according to circumstances and traversing the vise or piece of work being set with the table screw, its truth can be measured and adjusted in a very satisfactory manner. There is almost no limit to the usefulness of this little joker. F. W. UNGER.

A Collapsing Tap.

Editor American Machinist:

In Fig. 1 is shown a collapsing tap which I designed and have tested with very satisfactory results. The sketch shows a

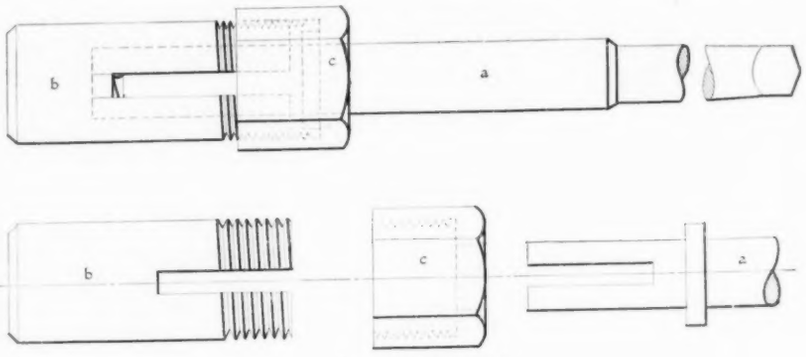


FIG. 1 COUNTERBORE

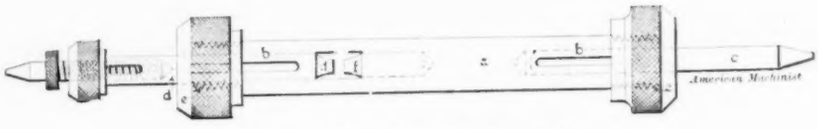
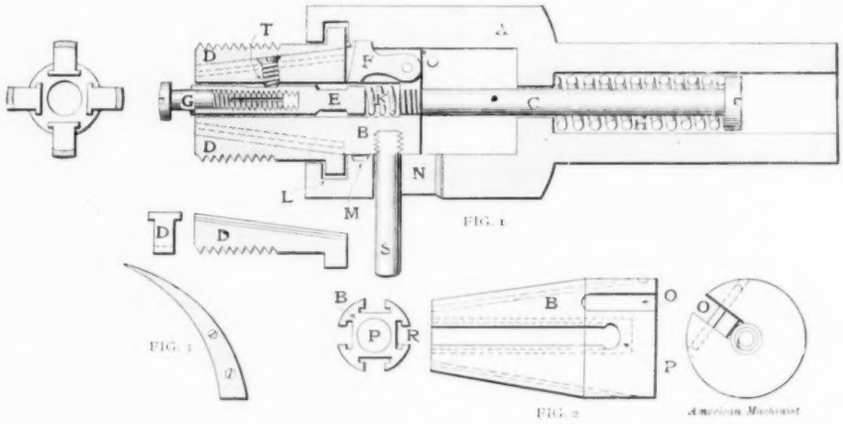


FIG. 2 A PAPER SHRINK GAGE

1-inch iron pipe tap. The body *A* was made of 2-inch machine steel 6 inches long, the shank end being fitted to the turret, the size in this case being 1¼ inches, leaving 3 inches of the stock at the other end the full 2 inches diameter, with the exception of a finishing cut. The shank was bored to a depth of 3 inches by ⅝ inch diameter, and the front end 1¼ inches diameter by 2¼ inches deep, an 11/32 hole through the remaining wall. Three sixteenths of an inch from the end a recess *L* was made ¼ inch wide and ¼ inch deep. One sixteenth of an inch back of this another recess *M* was made 1-16 inch deep by ¼ inch at the top with sides an angle of 60 degrees. Back of this a slot *N* ⅞ inch long by 17-64 inch wide was made. The taper piece *B*, Fig. 2, was made of tool steel 2⅜ inches long, ¾ inch diameter at small end, and tapered to full size ¾ inch from the large end, with a ⅜-inch hole 2⅛ inches deep drilled from the small end. The large end was drilled and tapped to receive screw *C*, Fig. 1. A slot *O* ¾ inch long and 7-16 inch deep, cutting through into hole *P*, was made to receive pawl *F*. Four slots *R* were milled parallel with the taper sides, as shown. The four chasers *D* were milled in one strip to a nice sliding fit in slots *R*, and they were then cut off to length, turned up and the thread chased on; the stop *E* and adjusting screw *G* explain themselves. *E* is of machine steel drilled and tapped, with a slot to receive point of screw *T* and a groove to receive end of pawl *F*, when the stop is pushed back. Adjusting screw *G*, of tool steel, is split down on thread end and spread a little before hardening. *F* was of tool steel, as was pin *S*. All tool-steel parts were hardened and tempered, the body *A* being case-hardened.



A COLLAPSING TAP.

The action of the tap is as follows: Assuming it to be set ready for action when the stop is pushed back, pawl *F* is

forced down into groove *E*, releasing plug *B*, which will then be pulled back by spring *H*, thus contracting the chasers. To set the tap again, a piece, shown in Fig. 3, was fastened to the slide back of the turret. As the turret revolved, pin *S* passing on the outside of this piece is forced ahead, when spring *K* forces pawl *F* back into groove *M*, locking the parts for action. The stop-screw *G* in this case was for globe valves. For other classes of work this screw can be made longer or its head larger to suit the requirements.

JOHN GRAVES.

Making an Index Plate.

Editor American Machinist:

The sketch and description explain how an index plate was accurately spaced and bored on a boring machine.

Fig. 1 is a top view showing the index plate clamped to the platen of the boring machine, and the stop *A* used in spacing. Fig. 2 is an end view, and shows the worm gear, which is a part of the boring machine, and which was used for spacing when the first or roughing cuts were taken through the index pin holes.

A disk *Z* was turned to fit the large hole in the index plate and clamped to the platen. To get it exactly in line with the center of the boring bar, a stud was fitted to its center and a hole was bored through it, the sides at *x*, Fig. 3, being made to caliper alike by the process of cut and try. The index plate was then put on and hub No. 1 located properly. A temporary finger on the worm shaft and a mark on the end of the platen gave an accurate enough division for the first or roughing-out cut. For finishing, a light cut was first taken through the hole in hub 1. Hub 2 was then brought into position by the worm and worm-gear method, and the same size cut was taken through it. With hub 2 unchanged, an adjusting block, Fig. 4, was adjusted to fit between plug *B* and stud *C*, and hubs 3 and 4 were then located by putting plug *B* in the hole just finished and turning the index plate around until the adjusting block would slide between plug *B* and stud *C* and just touch both, when a cut was taken through the hubs.

Hub 1 was then located as nearly as possible in the same position as it was when bored out last by getting the boring bar cutter to make a light mark all around the hole. Then the difference in the space between plug *B* and stud *C* was found by comparing the original size of the adjusting block and its size when set to fit between *B* and *C*, now that hub 1 is located in the boring position.

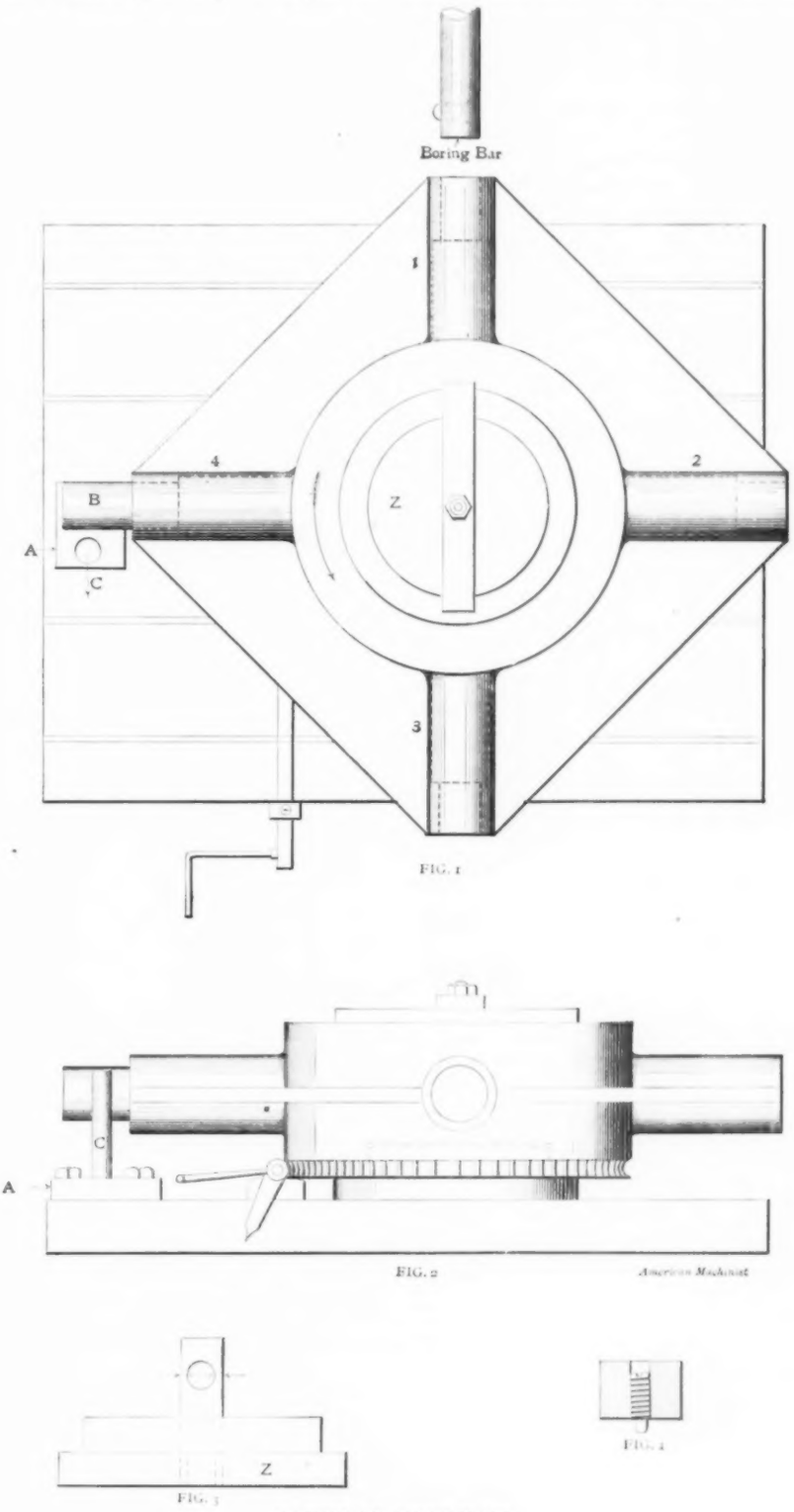
This difference was the accumulated error, which was divided by 4 and added (in this case) to the original size of the block. Then the holes were all bored out again. A few trials like this sufficed.

H. T. G.

Asbestos for Thin Cores.

Editor American Machinist:

Out some eight or ten miles on a country road "biking," I came to what seemed to be a wheelwright shop. I stopped off and found it to be a farmer's workshop. He was making a wheelbarrow and was also willing to talk. After some conversation he began to take small patterns down from the loft. In looking them over there was one which got my eye on account of the peculiar core print, which was for a core about 1¾ inches long, 1⅜ inches wide and 3-32 inch thick through a casting not over ⅜ inch thick. On asking how the core was made, he smiled and acknowledged that there had been some trouble and that two foundries had given it up, but that he had got some asbestos packing and used in place of cores with good suc-



MAKING AN INDEX-PLATE.

cess. This was new to me, and it may be to your readers. CHAS. A. HEALD.

Nashua, N. H.

A Driver for Milling Machine Cutter Arbors Doing Heavy Work.

Editor American Machinist:

Having occasion to cut a great many three- and four-pitch cast-steel gears, I found it impossible to make good time on them when depending on the tang of the cutter arbor to do the driving, as the tang would twist under the excessive strain due to coarse feeds.

I therefore devised the driver shown in Fig. 1, which I screwed on the milling machine spindle in place of the protecting collar which usually comes with the standard makes of this class of machine. My method of marking off the keyways in the arbors was simply to remove the tool-steel keys *a b* and insert the arbor in the spindle, turning it in the opposite direction from that in which the spindle rotates, in order to get the additional benefit of the tang in driving, and then transfer the keyway positions in the driver to the cutter arbor with a scriber. Since using this device we have had no more twisted tangs and we now cut a three-pitch tooth 4½ inches face in cast steel at one cut in eight minutes,

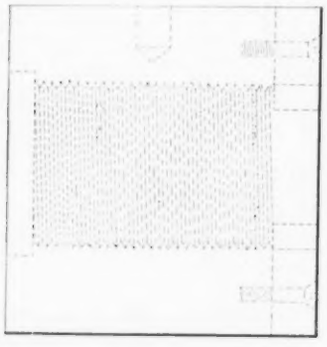
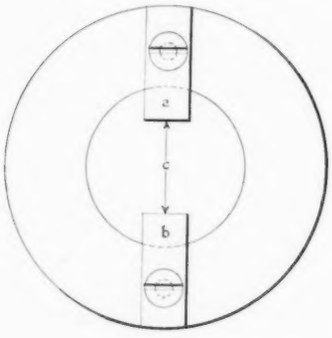


FIG. 1



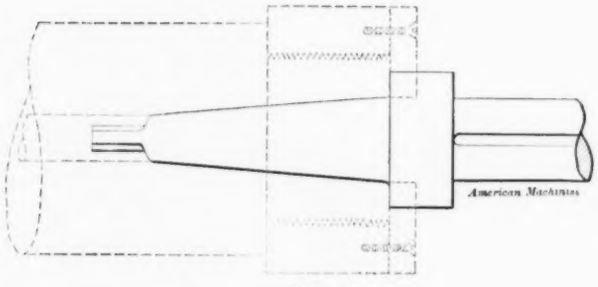


FIG. 2

MILLING MACHINE ARBOR DRIVER

where it took three times that long when depending on the tang only.

The body of the driver was made of tool steel left soft and the keys of tool steel, hardened. The distance *c* should be slightly larger than the largest diameter of the cutter arbor shank, to permit inserting the arbor without removing the keys. Fig. 2 shows the arbor in position in the driver and the driver in position on the spindle.

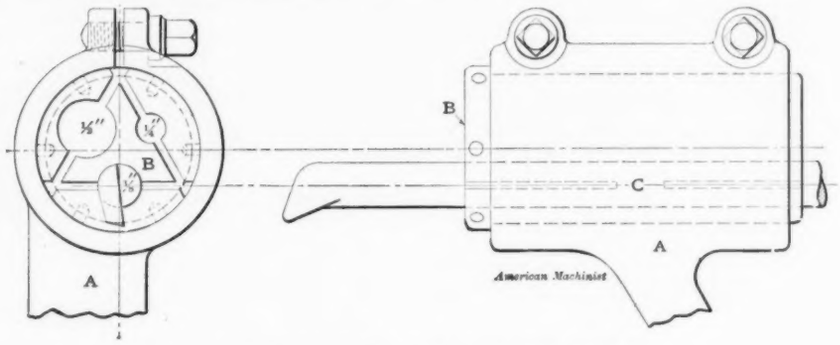
ROBT. A. LACHMANN.

Chicago, Ill.

A Convenient Boring Tool for Lathe Work.

Editor American Machinist:

The combination boring tool shown in the accompanying sketch embodies several features recommending it to the toolmaker or workmen running small engine lathes.



CONVENIENT BORING TOOL FOR LATHE WORK.

The main body of the tool *A* is a steel casting, bored, slotted and fitted with two clamping screws.

The inner shell of tool-holder *B* is made from a piece of 1½-inch tool steel, turned to 1¼-inch diameter, leaving a short shoulder at the front end, in which are drilled six small holes for entering a key, used for adjusting the tool to hight or swinging the different sizes of tools into place as required. The shell is drilled to take ¼, ⅜ and ½-inch drill rod, which may be forged at the end for boring of threading tools. The illustration shows the ⅜-inch tool in place, ready for operation.

Slots are milled parting the holes from each end of the shell, leaving about ½ inch of section at *C* to hold the tool shell intact.

The idea for the split shell was suggested by the ordinary spring chuck used on the spindle of small turret lathes and screw machines. Such a tool as the one shown herewith might be made cheaply in lots of a dozen or more, no fine degree of accuracy being required in its manufacture. D. E. MACCARTHY.

Planing "Out of Wind."

Editor American Machinist:

Planing a board of any width and length by hand, so that it will be true, need not call for any special talent on the part of a patternmaker, yet tradition and bigotry are responsible for the survival of the belief that expert handling of "winding strips" furnishes the only correct means of planing a board surface out of wind.

As this apparently hard-and-fast shibboleth has still many adherents, an attempt to shatter the long-established belief and practice is at best but a thankless task. The use of "winding strips" is so manifestly unnecessary that the chief wonder to any thinking man is, that the use of them didn't "die abornin'."

My contention is that a plane and a straight-edge, ably assisted by a good right arm and at least one eye that can see a hole in a ladder, about complete the outfit for planing true work, though a workboard or bench reasonably true on the top to rest the piece on, is important enough to be considered as a means to a desirable end.

Using the straight-edge only will determine, much more accurately than winding strips ever did or can, just how true the board is, by first resting it diagonally from corner to corner, then reversing to opposite corners, and if the board be of sufficient thickness not to be influenced by any irregularities of the bench, and if the

straight-edge lies evenly both ways, the piece is bound to be true. If the piece is thin and wide, and is apt to be distorted by whatever it may lie on, let it rest on its edge each time you try the straight-edge. To exert any undue pressure on the straight-edge will not help matters in the least, but rather prolong the agony, so that the time consumed will then almost equal the world's record now held indisputably by the winding-strip fiends.

I am convinced that if the users of winding strips will try the straight-edge method and saw out as many Ping-pong racquets as the stock in the strips will permit of, and present the same to their friends as souvenirs of an ancient and dishonorable system of robbing employers, they (the winding strips) will be put to better use than they ever were before.

OLD BOB.

Drop Forging a Ratchet Drill Handle.

Editor American Machinist:

Fig. 1 of the accompanying drawing is a shell and handle for a ratchet drill, and Fig. 2 shows the piece of stock from which it was made. The width of the bar of stock to be used was determined by the length of the shell and the thickness was a trifle more than twice the thickness of one side. The length was determined by experimenting until the proper length was found.

Fig. 3 shows the first operation, which was done on a cushion hammer with a pair of dies shown in Fig. 4. This operation required considerable skill in the operator, but made a nice job if the piece was properly handled. The stock for an entire order was cut to length and each piece put through the first operation. The second operation, shown by Fig. 5, required another handling.

The dies for this operation are shown in Fig. 6. They were of cast iron and contained two splitting chisels and an expanding mandrel as shown. *X* in Fig. 6 is a steel stripping plate to draw the forging from the mandrel after the blow is struck. Two blows with this pair of dies were necessary. The first one with the splitting chisels formed the piece as shown in Fig. 5, and the second one expanded it as shown in Fig. 7. The expanding mandrel was slightly larger than the forging was to finish, so that the mandrel used for the finishing operation would drop freely into place.

In the second drop was a pair of steel finishing dies that were duplicates, one of which is shown in Fig. 8. The amount of stock was calculated so nicely that very little fin was made and the piece was not hot trimmed at all. The flash is shown surrounding the piece of work.

This job was designed by a boss blacksmith who has since joined the majority. He was a fine old gentleman and a No. 1 mechanic, and I believe the greatest crime he knew was to waste stock in performing a forging operation.

He came to grief one time, however, on this particular job and wasted material for an entire lot. It was necessary that the iron should be first class to stand the strain of splitting. Knowing this he always made a few samples from each lot of iron to test it; but one time, for some unaccountable reason, he failed to take this precaution, and of course this must be the particular time when the stock was poor.

He cut off the entire lot and drew down the handles, and when he started the second operation nearly every one of them split at the end, and there was nothing to do but scrap the entire lot.

This confirms the generally understood fact that, however competent a man may be, he at some time or other relaxes his vigilance a little, and it seems as though this happened in most cases when he should have been more alert than ever.

THEODORE.

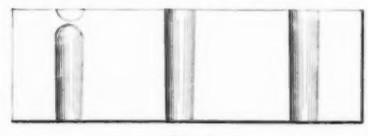


FIG. 4

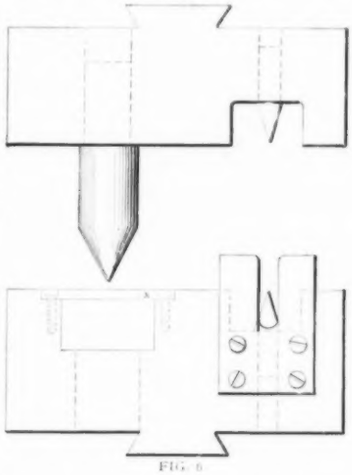


FIG. 6

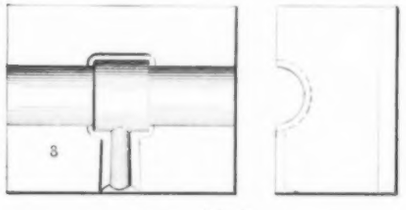


FIG. 7

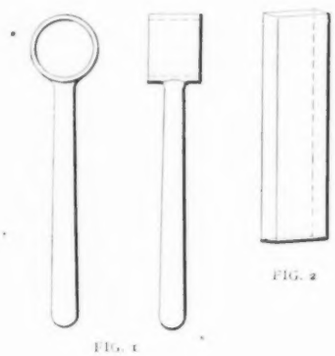


FIG. 1

FIG. 2

FIG. 3

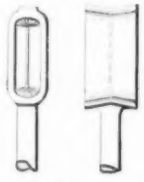


FIG. 5

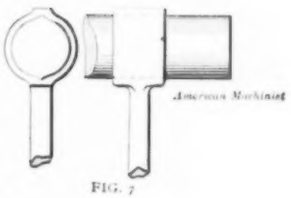


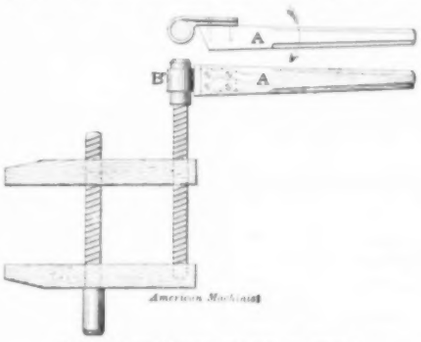
FIG. 7

DROP FORGING A RATCHET DRILL HANDLE.

For Tightening Hand Screws.

Editor American Machinist:

I send a sketch of a handy device for gripping hand screws. It is very powerful and more effective than gripping by hand, and may prevent many a blister. *B* is a piece of leather belting screwed to handle *A*. Moving the lever in the direction of the arrow tightens the strap on the handle and the reverse movement releases it.



FOR TIGHTENING HAND SCREWS.

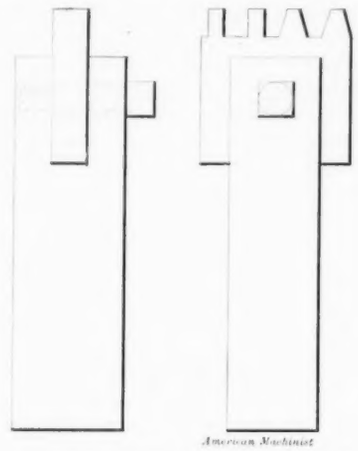
B. M.

[This may be, in disguise, merely a device for stripping the thread from the screw. We have seen many so stripped without the aid of a lever.—Ed.]

The Chaser for Cutting Worms.

Editor American Machinist:

The hand-chasing tool as a means of cutting threads is, I believe, older than the engine lathe or the slide rest. As a fixed tool in the tool-post it is still a very good tool for certain purposes. I have



CHASER FOR CUTTING SMALL WORMS.

used it a good deal for cutting small worms up to ¼ inch pitch and it seems to me an ideal tool, especially for double threads. In cutting a double-thread worm there should be four cutting points (see sketch), the first two being square-nosed and the others for finishing. In cutting a worm by the usual method it is necessary to rough with a square nose and to finish with a properly formed tool. This is slow in every way. The square nose has to be carefully made or it will not have the right side clearance, and of course the finishing tool has to be made right. This takes time; and each cut has to be taken separately, which means more time. Then in cutting a double thread care has to be taken to get each the right depth, and sometimes the spacing has to be done by hand through the gears. Such a tool as I show removes most of these obstacles to rapid production. The roughing and the finishing go on simultaneously and under the most favorable conditions, as a square nose cuts best if you can constantly relieve the sides, and such a forming tool if it cuts the sides only. The depth, of course, is obtained without gaging. With water for a lubricant it requires only a trial to demonstrate the advantages of this method. The chaser is made—with no question as to side clearance—by putting it in the tool-post and cutting it with the hob on the centers, and it takes very little time. The roughing points are of course filed on the sides to make them square-nosed. It is quite easy to demonstrate with such a tool that the weak point in thread cutting is not the point of the tool, but is in most lathes the mechanism for moving the carriage.

T. A. B.

A Grinding Attachment.

Editor American Machinist:

The accompanying sketch is an attachment to use on a small emery wheel. Fig. 1 is a plan of the attachment in position for use, with a gage clamped on to be ground. Fig. 2 is an enlarged end view of it, and Fig. 3 is a sectional view through *A B*, Fig. 2. The attachment is composed mainly of two parts, which are *B* and *C*, Fig. 2. *B* is a flat table with three T-slots on top and one T-slot and one V in front. This table is connected to *C* by the bolt shown at *D*, Fig. 3, which is a nice fit, so as to have no looseness whatever between the parts. *C* is the part that fits on rod *E*, Fig. 1. It is also supported on rod *F* and is split to clamp fast to rod *E*. The end piece *G* is for adjustment, so that the plate *B* can be placed in any desired position and held there by the thumb nut *H*. The plate *B* is cored out as much as possible to make it lighter to handle. The parts *A* and *B*, Fig. 4, are the adjusting collars and clamps. The collars *A* are placed one on each end of rod *E* with the screws for adjusting up against the rod bearings, and the clamps *B* are for holding the work against the table. The V at *A*, Fig. 2, is for holding pin gages, and can also be used for other work. The attachment can be used for quite a number of purposes. For instance, I use it for grinding off the ends of pieces for dies that are too large for our surface grinder. The emery wheel used is recessed out so that it can travel across the part to be ground. The tool is especially useful in the grinding of snap gages.

C. ALIPER.

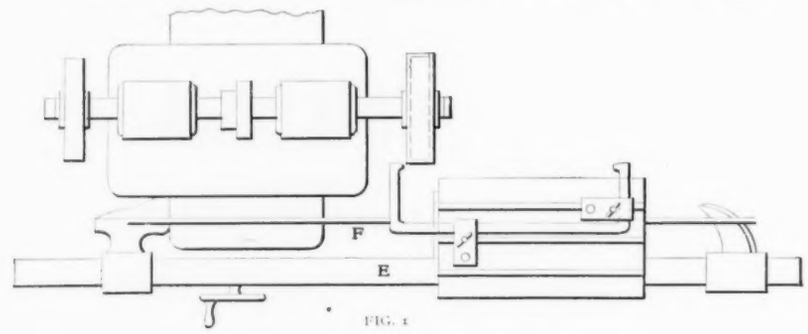


FIG. 1

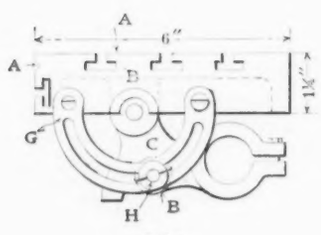


FIG. 2

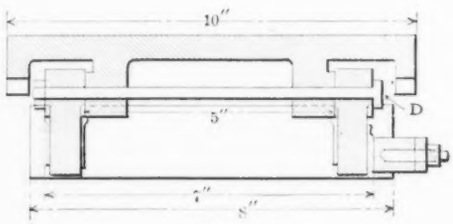
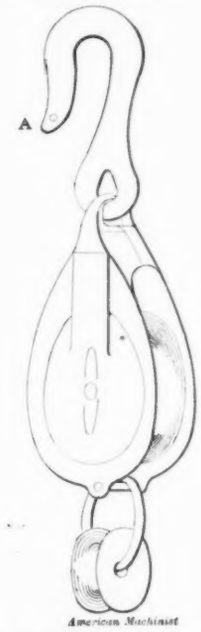


FIG. 3

A GRINDING ATTACHMENT.



ROPE BLOCK FOR THE SMOKESTACK.

Painting the Smoke Stack.

Editor American Machinist:

The 60-foot by 30-inch unlined steel stack needed painting. As there was no ladder up, the question was, to get a pulley hooked over the ½x1¼-inch band at the top.

FIG. 4

A jointed pole was procured and the pulley attached, but failed to do the work. Then the scheme of getting a rope hanging over the edge, inside and out, was re-

sorted to. All agreed on getting a light cord over first, and with it pull over a heavier line. Kite flying, the strong-armed man who could throw a nut over, and a skyrocket sent up the inside, all failed to land the cord over. A small tissue-paper parachute, with the cord attached, was made, and with the heat of a burning newspaper it floated out, fell free and quickly did the business.

With the cord a ½-inch line was drawn up from the outside. In the nose of the hook at *A* a small hole was drilled and a wire run through it. In this way was the ½-inch line fastened to the hooked block. The object of this was to insure that the hook would hang just right to hook on the ring when pulled up and the line eased off.

The block with a ¾-inch line through it was pulled up and dropped right into place. The rest was easy; in a short time the stack had its new coat of black. The pulley was left up, with a wire through it, for future use.

Another case of Columbus and the egg. Dead easy when you know how.

OIL STONE.

[What was the matter with the skyrocket?—Ed.]

For Standard Tapers for the Tangs of Woodworker's Tools.

Editor American Machinist:

I wish to offer a suggestion which I think will meet with the approval of edge-tool manufacturers and which I am sure will be of great help to wood workers in general:

A short time ago I bought a set of tang chisels and gouges without handles. Now if there is anything about tools that the mechanic in general dislikes to do it is putting handles on tools, and the reason is that the tang or part that enters the handle is made in so many different tapers and sizes. I just set to work and made the tangs on the chisels I bought as near a standard taper as possible without destroying the strength of the tang, then I made a reamer from an old square file to correspond with the taper on the tang. I made handles for chisels by drilling a small hole in the center of each handle and then run the reamer in far enough to make the handle a tight fit on the tang. I did the same thing with my turning tools, and now I can put a handle on my chisel in a few minutes which sometimes it took half an hour to do.

My idea is to manufacture tang chisels with a standard taper, and a reamer of the same taper to fit in a bit brace. In making the handles, drill a small, straight hole half way through the center of the handle. This will be a guide for the reamer. I am sure this combination will meet the approval of mechanics.

Another improvement which would be of assistance to mechanics would be to have the size of chisel or gouge stamped on near the handle. For flat chisels the width could be stamped and for gouges the radius. It is an every-day occurrence to see a man take from his tool-chest three or four gouges to find one that will fit a core box or any other circular work he may have in hand. WOODWORKER.

Cutting Threads in a Boring Mill.

Editor American Machinist:

It is not every day that a boring mill is used for cutting threads and certainly not every mechanic would think the job feasible in so simple a manner as the one of which I send you a drawing.

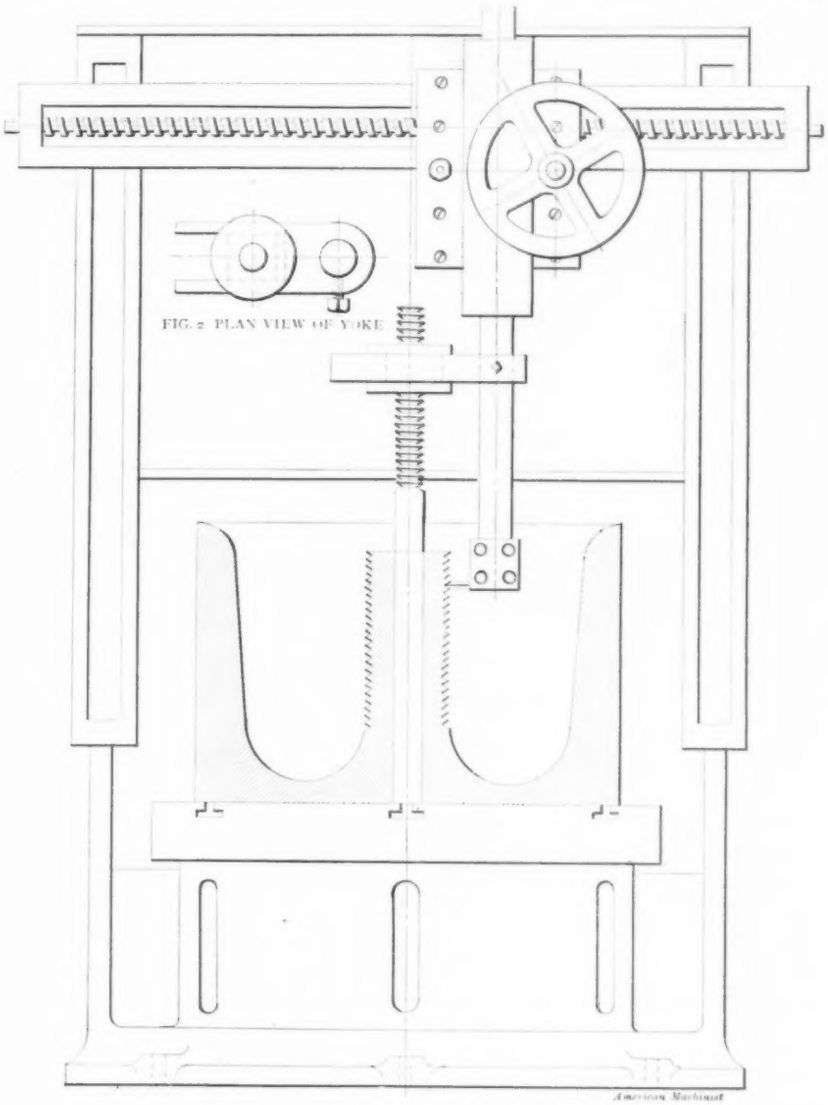


FIG. 2 PLAN VIEW OF YOKE

American Machinist

FIG. 1. CUTTING THREADS IN A BORING MILL.

The job consisted of a lot of special pistons to be turned, bored and have a thread cut on the outside of the hub.

The machinist was one who believed in doing things, rather than in making excuses, and when he found it impossible to get the big lathe for the job he did some thinking. This resulted in turning up a short section of shaft, fitting one end to the bore of the piston—in which it was held by a set-screw—and threading the other to correspond with the pitch of the thread to be cut upon the hub.

The yoke, shown in Fig. 2, was one used for another purpose, but answered very well for this. The traversing nut was cast in place on the thread in a mold made of clay and an old tobacco box, and was fitted up to suit the yoke. Thus equipped, by operating the cross-feed screw to move the tool to and from the cut and attending to the reverse properly, the threads on half a dozen pieces were cut in good shape and in good time, with very little expense for special tools. W.

"Keep Posted."

Editor American Machinist:

One evening, on my way home from work with a friend, I called at a news depot to get my AMERICAN MACHINIST. Said I to my friend: "I suppose you get this paper regular." "No, I used to take it regular, but I don't now; I take it once in a while when I find some good things worth reading." I said: "I can always

find 8 cents' worth of good reading and information, if in nothing but the advertisements." In the course of the conversation my friend wanted me to call at his house to see an invention he was working on (and at the same time getting rid of all the loose change he could scrape together). I called and saw the invention, and it struck me that I had seen a machine for the same purpose in the AMERICAN MACHINIST. I looked it up and found I was right. I called his attention to it. He looked at the paper, then at me, and he said: "All my time and money gone to hell. If I got that damn paper I would be ahead now. Hereafter I spend my 8 cents and keep posted." D. E. M.

A Shop Time Ticket.

Editor American Machinist:

There have appeared in the AMERICAN MACHINIST from time to time specimens of shop time slips or cards, and I enclose herewith specimens of a time slip which I have designed and had in use the past few years with very satisfactory results.

Each employee receives a tablet consisting of about 100 of these slips, which he will tack or hang up at a convenient place in the shop, with a pencil suspended with a string. It will be seen by the illustration that Jones went to work at 6.45 o'clock and at once drew a line opposite those figures, with a description of his work directly under same. When he was instructed to take up another job, he glanced at the clock and found it to be 8.15 o'clock, where he drew a line and described the new job. If the job number system is adopted, he uses the number instead of describing the work, as in the second and succeeding cases of the ticket shown. At 10 o'clock he was shifted to job No. 75, at 11 o'clock to No. 35, and so on to the end of the day. It will be seen that the workman is relieved of all calculations of the number or fractions of hours of time on each job, and has nothing to do but to enter the jobs and sign his name. When the time slip is handed into the office, the time-keeper can enter the time of the different jobs very rapidly into the job book, with the assurance that he has it exactly correct. He is not left to the mercy of the workman's summing or figuring the number of hours on his jobs for the day. By filing these slips according to date and number, reference can be made in a few moments to the original records and comparisons made in the event of question or doubt. E. H. KREIDER.

For E. H. KREIDER, Lancaster, Pa.

I have worked this 18 day of Mar. 1902

FROM		FROM	
6:45		1:00	
7:00	Grinding	1:15	#10
7:15	Reamers	1:30	
7:30	for Shop	1:45	
7:45		2:00	
8:00		2:15	
8:15		2:30	#15
8:30	#40	2:45	
8:45		3:00	
9:00		3:15	
9:15		3:30	
9:30		3:45	
9:45		4:00	
10:00		4:15	
10:15		4:30	
10:30	#75	4:45	#80
10:45		5:00	
11:00		5:15	
11:15	#35	5:30	
11:30		5:45	
11:45		6:00	
12:00			

Workman, John Jones

American Machinist

A SHOP TIME TICKET.

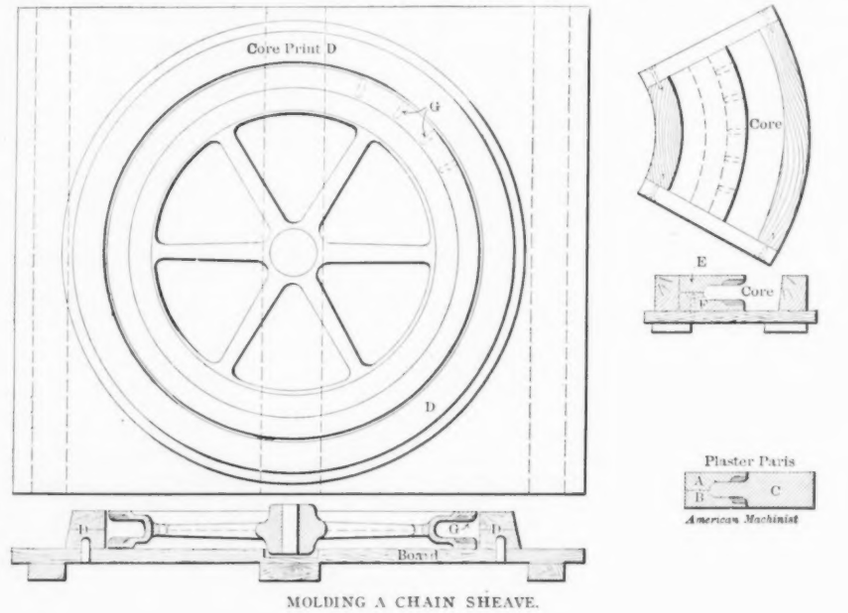
Molding a Chain Sheave.

Editor American Machinist:

I send a sketch of a method of molding a chain sheave. The sheave is 24 inches diameter, an ordinary chain sheave taken from stock, true in every way. A followboard was made large enough to take the sheave and flask. The sheave was placed on the board as shown, and the usual parting pieces were put between the arms to make the parting. Core print ring *D* was built around the sheave, made fast with screws to the board and then put in the lathe and turned true on the outside. Dowel-pins were then put in from the bottom of the board and the screws were taken out, leaving the ring free to lift with the sheave.

To make the chain groove, a plaster cast *C* was taken from the sheave. This was one-sixth of the circumference. From cast *C* two casts like *A B* were taken and fitted in a box, as in *E F*. A number of cores were made in this way to start the job, and when the plaster of Paris gave out, cast iron was made to take its place. as shown at *E F*.

Some patternmakers might hesitate to make the pattern in this way on account of the shrinkage. I hesitated myself, but the sheave came out all right; the chain ran smoothly, and that was all that was wanted. FOUNDRY FOREMAN.

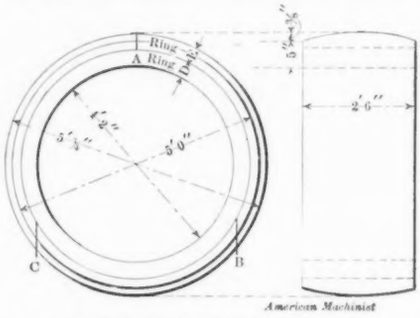


MOLDING A CHAIN SHEAVE.

Pattern for a Cast Steel Ring.

Editor American Machinist:

I send a sketch of a magnet ring, showing the method of constructing the pattern and the swell allowed on a pattern of this size. Patterns of this kind are sometimes made by staving the outside of the ring, drawing up the inner ring and then drawing the staves in. The method here shown is adopted by one of the largest steel foundries:



PATTERN FOR A HEAVY STEEL RING.

The pattern is made in two rings, *D* and *E*, built up in segments. Ring *D* is solid and ring *E* is parted at *A*, *B* and *C*. Ring *D* is first drawn out of the mold and pieces *A*, *B* and *C* are drawn in. In order to set a straight face on the casting, a swell of ⅜ inch is allowed. This ring serves to give an idea of the shrinkage in steel cast-

ings. With this 3/8-inch swell it will cast straight on the face nearly every time. Before making patterns for steel castings it would be well to consult the superintendent of a steel foundry. B. M.

Removing Rust from Tools.

Editor American Machinist:

To remove rust from tools or small pieces of machinery wind the end of a copper wire around the piece, and to the other end of the wire fasten a piece of zinc, putting both into an earthenware or glass jar filled with water with a few drops of sulphuric acid added—say, ten drops to the pint. Suspend the wire by running it on a stick across the top of the jar. S. AND S.

A Tool Holder and Tools—Self-Hardening Steel.

Editor American Machinist:

The sketch Fig. 1 shows a simple, home-made tool-holder for lathe or planer, with a set of tools in Fig. 2, neither of which

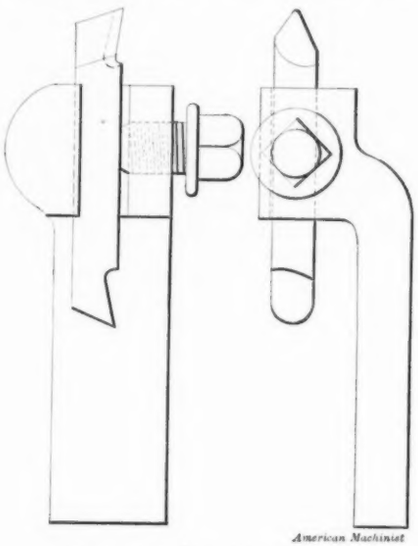


FIG. 1. A LATHE TOOL HOLDER.

will require description. A set of these tools and a holder of the construction shown will be found handy things for a toolmaker to have in his drawer.

A great many toolmakers complain about self-hardening steel cutting tools, and say that it is impossible to accomplish fine results in turned or planed work with them, and for that reason a great many will not use them. Now, when they say that for fine work they are useless they are right; as it is impossible to get the edges of such tools keen enough to allow of taking smooth finishing cuts. But for the preliminary work of roughing, for medium cuts and feeds and coarse thread cutting, machining cast iron in the shaper, planer or lathe and for turning brass castings, and also for accomplishing different operations on cast-iron parts in the turret lathe they are unequaled, and should always be used where the production of machine parts at the minimum of cost and labor is imperative. For the face milling of large castings where inserted tooth cutters are adaptable, the self-hardening steel tools will be found to give the best results. There is a grade of this steel on the market, in which it will be found possible to

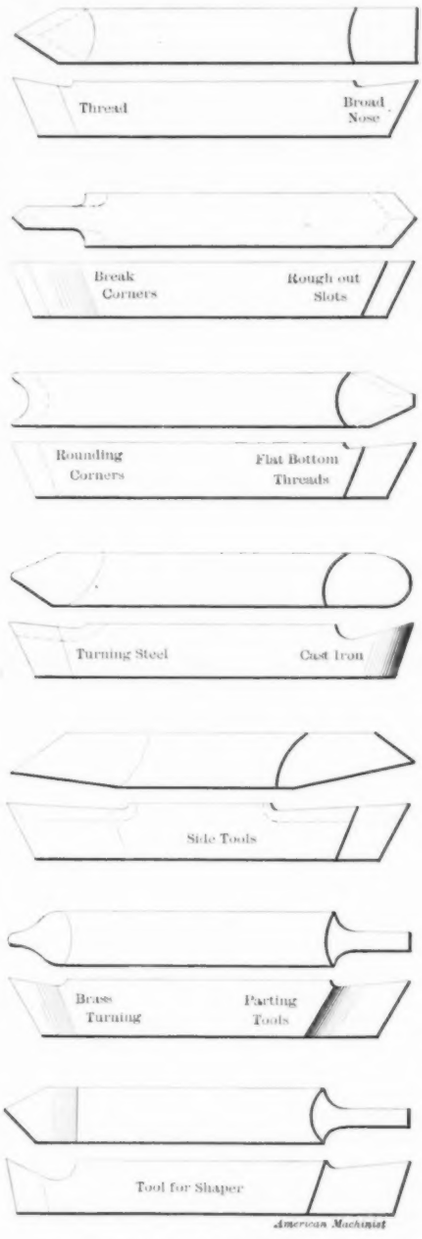


FIG. 2. SET OF SELF-HARDENING TOOLS.

hold an edge sufficiently keen to allow of its being used for the purposes above enumerated. JOSEPH V. WOODWORTH.

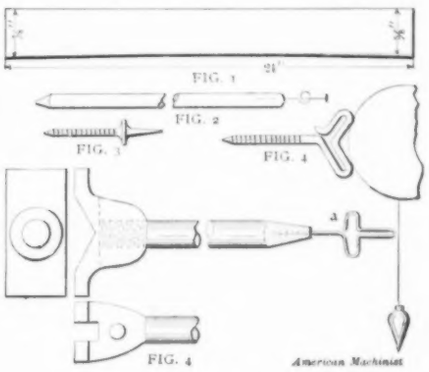
A Few Ideas for the Erecting Shop—Test Bar for Key Ways—Tools for Engine Work.

Editor American Machinist:

I laid out at one time a keyway in a large propeller wheel, and the superintendent sent a man—a powerful but extremely disagreeable cuss—to help me do the chipping. Of course, he got the soft side or smaller end of the keyway, for he always managed—by hook or crook, or both combined—to get the easy end of a job.

Well, it so happened that this chap, though having the soft side of the wheel, refused to chip to the line, thus leaving the inner end of my half low to the straight-edge. On my complaining he asserted that I had gone too deep and that his end was right. I therefore called another man to test it, and he announced that the depth marks were more than 1/8 inch below my partner's chipping line, a fact which was very plainly evident. On my way home that evening I called at a dealer's and purchased a piece of steel 2 feet long. This I proceeded to make into a straight-edge, as shown in Fig. 1, 7/8 inch wide at one end, and 5/8 inch wide at the other, thus giving it a standard keyway taper of 1/8 inch per foot. When using this straight-edge, one caliper or gage setting sufficed for testing the depth of keyway from end to end. If one leg of caliper has a broad end, a notch may be cut therein, as shown in Fig. 5, to straddle the straight-edge.

Figs. 2 to 5, inclusive, are combinations.



TOOLS FOR THE ERECTING SHOP.

In setting a line central with a cylinder —especially a free plumb line—the ordinary inside micrometer caliper gages are of no use whatever; the lightest are far too heavy for such work. Workmen generally stick a common pin in one or both ends of a light stick of soft wood, and I have had lots of fun watching a man after driving the pin a trifle too far pull it out with his teeth (of course too far), then drive it in again very gently, but usually getting it in too far and having to start all over again.

Many who read this will recognize the picture. As I did not like to use my teeth as a nail extractor, I formed my pins, as shown in Fig. 2, making them act as screws, generally by slightly notching or roughing them with a sharp chisel edge, so that I could adjust them quickly and accurately by turning them in the stick. Fig. 3 is another pointer with a regular screw thread for adjustment; this pointer and the one shown at *a*, Fig. 5, being made for sticks too long and heavy for the light pins. The screw, Fig. 4, is, as shown, for measuring from a shaft or other cir-

cular object; it can be used, for instance, in getting the distance between shaft and link pins for lengths of eccentric rods. The block, Fig. 5, may be used the same as Fig. 4, or can be used from a plane surface. I have these blocks plain and also notched.

Several years ago I watched a workman trying to set a cylinder plumb line central with the slide of a good-sized vertical engine. He got a light surface gage and, placing the base against a slide, he tried to aline the pointer to the plumb line, but every time, just at the critical moment, the surface gage, though but a few ounces in weight, seemed to weigh a hundred pounds. To prevent the atmosphere becoming stiflingly sulphurous, I took from my box a base like Fig. 5—without the V-groove—cut a stick, inserted a pin, handed it to the man, telling him how to adjust it. He very soon completed the job and all was lovely again.

I. W. PAYLER.

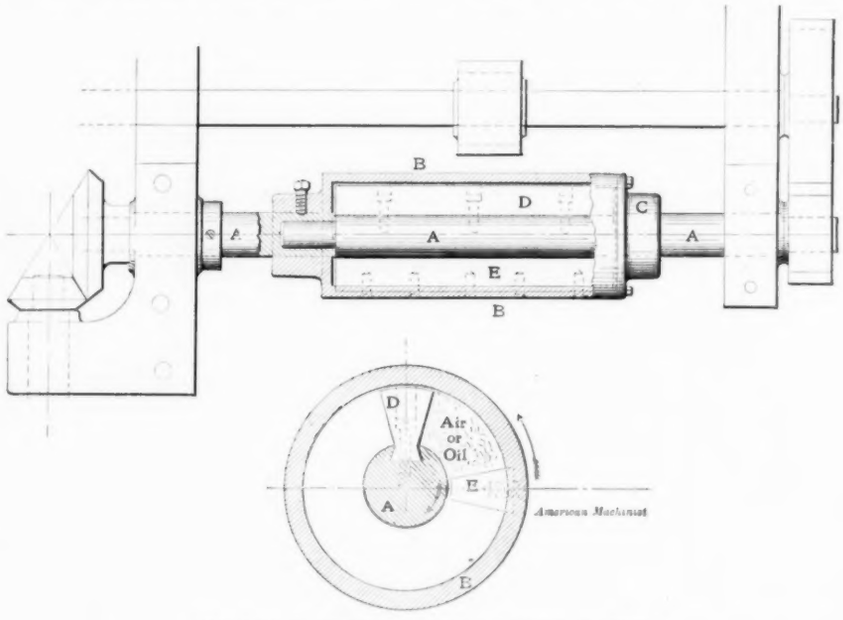
A Rotating Dash-Pot Used in an Attempt to Increase the Return Speed of a Planer.

Editor American Machinist:

I suppose most of your readers have heard of different attempts that have been made from time to time to increase the return speed of planers, although I have subscribed to the AMERICAN MACHINIST for the last fifteen years without, so far as I can recall, seeing anything on this subject before. Of course the manufacturers of planers must have experimented a good deal with different speeds before they settled down to the present return ratio, which, I believe, rarely exceeds 3 or 3½ to 1.

I have in mind an experiment that was tried in a shop where I was working some ten or twelve years ago. An inventor came along one day, with drawings and other necessary information about a scheme to make the planer table return 7 to 1. The table was guaranteed to stay on with no broken gears and no slipping of belts. The boss agreed to let him have the use of our large Pond planer for his experiment and I was assigned to work out the mechanism, which at the time I considered a great honor.

The accompanying sketch, although not drawn to scale, will give a fair idea of the scheme. *A* is a shaft that took the place of the bevel gear shaft for the driving mechanism under the planer. It was 2½ inches diameter and was made in two parts, one being shouldered and fitting into the other with a running fit. *B* is a cylinder closed at one end, with a hub, and three set-screws to fasten to the female end of the shaft, as shown; the other end of the cylinder being open to admit the shaft, with a separate end piece *C* bolted to the cylinder, with a hub to serve as a bearing for the male end of shaft. Upon the shaft and dovetailed into it was a piece of cast iron *D*, the full length of the inside of cylinder, with just clearance enough at the ends to allow it to revolve freely. The cylinder was bored out smooth and the said piece of cast iron or rib, as I should call it, was turned to a radius of .015 smaller than the cylinder bore. Dovetailed into the cylinder and fastened from the outside with machine screws was a corresponding rib *E* pointing in toward the center and coming within .015 of touching the shaft. The idea was this: When the planer reached the end of forward stroke and was going to reverse, the rib *C* would be thrown back against rib *D*. This would involve almost a full turn of the shaft and the time required for this was calculated to be sufficient for the belt on the quick return pulley to get a good grip and start the table on the "home stretch" at 7 to 1. It was also thought that the air in the cylinder would be compressed and act as a cushion between the ribs, so as to lessen the danger of breaking gears by reversing too suddenly. That is what it was expected to do, but here is what it really did: After a few false starts which extended over a period of three or four nights, for all the work of rigging up around the planer for experimenting was done at night, as the inventor wanted to be *right there*, we finally got everything ready, and when he came around, about 4.15, I put the apparatus in place under the planer and started her up.



ROTATING DASH-POT FOR QUICK-RETURN PLANER.

You will understand that by this time the whole shop was wildly discussing the burning question "Will it?" or "Won't it?" (the "won'ts" having it by a large majority), and consequently it was no more than I expected to see the men perched on every conceivable point trying to get a view of the proceedings, the patternmaker sitting on the stairs right at the end of the planer. She started forward at a nice, easy gait, got to the end and tried to go back; hesitated a little, while the belts squeaked like ten thousand demons trying to get a grip on that little pulley. Finally, she took hold and off she went on the return trip. Well, sir! the stored up energy in that table was something wonderful to behold. Everybody in the immediate neighborhood "took to the woods," so to speak; the patternmaker was never known to get up those stairs before with such lightning like alacrity. The table slid back about two feet beyond the big gear and was just about balancing on the ways preparatory to going on the floor, when somebody jumped in and held it up, the belts and pulleys meanwhile racing against time until I recovered myself and threw the shipper over. After putting the table back again we gave it another trial with the same result, excepting that the belt insisted in staying on the loose pulley and I had to use a stick to force it over on the tight pulley and had to hold it there while the table raced back, this time breaking the shipping lever down at the side of planer and sliding back beyond the gear as before. That was the "official" attempt, which certainly resulted in a victory for the "won'ts."

The inventor calmly surveyed and seemed to be satisfied with the results so far, and the next day when he came around I had it all taken apart, according to his orders. Then for the first time he began to consult me, not about new ideas (he was full of them) but about the best way to work them out. This next move was to fill the cylinder with oil and by drilling holes through the ribs *C* and *D* we thought we would be able to better regulate the time required for the shipping of the belt from slow to quick and *vice versa*. We drilled a hole longitudinally through the shaft to connect with the in-

side of the cylinder through smaller holes in the side of the shaft, and put a plug and a pressure gage in end of shaft to record pressure in cylinder and also detect "irregularities" in the working of the quick-return scheme; but we never could make it do jus what we wanted it to do, and it certainly did a lot of things that we did not want it to do, and after a while my inventor's visits became less frequent, and finally he stopped coming altogether, and for several years after we kept the cylinder, shaft and gearing piled up in a corner, out of the way. That was only one attempt, but it was enough to convince both the inventor and myself that a return speed of 7 to 1 was a little too fast, at least with our arrangement. C. H. M.

Progressive Standards of Work.

Editor American Machinist:

"Good Enough" seems to be a handy thing to harp on, and a topic that any correspondent of the AMERICAN MACHINIST can use. I have had two or three whacks at it at different times, and here goes another. The beauty of it is that when you go to harping on it there are so many and such different tunes you can play with it. A workman gets scolded because he is satisfied to scratch along doing his work just barely good enough to pass inspection, and of course he never advances. And then we scold the man again on the other side because he is not satisfied with good enough, but just goes on doing work too good, working often to make something look nice when it is, when in use, to be evermore hidden from sight, and all such foolishness as that, wasting time and making a job cost more than anybody wants to pay for it, knocking off the profits and driving away customers.

The fact is, I suppose, that good enough is never an absolute and stationary standard, but only relative and always advancing. We are always satisfied with the best that is to be had and brag over our success in obtaining it, but the moment that someone has something much better our pride and gratulation are turned to shame and discontent.

I don't have to look so very far back to note how "good enough" has advanced in the details of machine-shop work. I can remember when I used to be running a lathe and doing things in the old-fashioned way. We used to do all kinds of work in every shop in those days, and of course we used to build steam engines. We built them, as we did everything else, without gages or standards of any kind, and a single piece at a time, without any thought of interchangeability or anything else except that the related pieces of the individual engine should go together some way.

A job that I would be very likely to get in those days would be the piston rod to turn up, and as this would have to pass through the stuffing-box follower or gland, I would get that to bore out first to fit the rod to. The hole in it might be, say, 2 inches diameter and 4 inches long. I had by long experience learned that the lathe, 20 inches swing, would bore taper—bigger at the back—so this I had to look out for when I had a job of boring. I would get the follower true and tight in the four-jawed chuck, set the inside calipers to 2 inches on my two-foot rule, in this case wiping the rule, and start a roughing cut in the hole with a boring tool, the hole probably cored 1¾ inches. After this cut I would take a second and lighter cut, and then begin to think about the finishing operation. I would grind and reset the tool and before starting to bore again would make a chalk mark an inch back of the cutting point and two other chalk marks an inch apart back of that. It happened that the lathe had a tilting rest, held down by a big weight, a convenience—the tilting rest, and not the weight—that I have not lost appreciation of to his day. So, after starting a light cut and running in an inch, or to the first chalk mark, I would turn the elevating screw at the back of the rest a little and swing the tool in, repeating this operation at each succeeding chalk mark, thereby compensating somewhat for the taper boring trick of the lathe. When the tool got through I would stop the lathe and caliper the hole. I might, and probably would, find that the hole was still a little larger at the back, so I would run another cut through and turn the elevating screw a little further than before at each chalk mark. This cut, or perhaps one more, would make the hole good enough, and then I could take the piece out of the chuck and have it all ready to turn the piston rod to fit it; but in connection with the stuffing-box follower itself, before we take it out of the chuck, comes in another story of the movable "good enough" standard.

In those days all the fellows in working on a stuffing-box follower or any such thing as that would first bore the hole and then stick it on a mandrel and turn up the outside and face the flange, and that practice had been good enough all along in those days and in that shop. I had turned up many followers in that way, but I didn't like the scooping out of the end where it sets against the packing. It took a special tool to do it right, and then you couldn't do it very well without digging into the mandrel. It happened that when I had one of those followers in the chuck one day it occurred to me that I might scoop out the packing end of the follower while I had it in the chuck, and it was done almost as soon as it was thought of, and better looking than any I had ever done before. I did the same trick on the next one that came to me, and by that time I had thought a little further and turned the outside also and faced the inner side of the flange before I took it out of the chuck. Of course then I chucked it again and faced the outside of the flange, and thus the follower was entirely turned in the chuck. Turning those followers on a mandrel had been good enough up to that time, but it was never good enough after that because it was distinctly better and cheaper to do them in the chuck.

Well, the hole being bored, I was then ready to go on with the rod. I would get it central and faced on the ends and then start a roughing cut over the whole length of it. The parts that were to be turned smaller at each end for the piston and cross-head, I would rough down below the finish size of the body of the rod to get that part out of the way, and then I was ready for the finish cut. For this I would set the calipers as carefully as possible, leaving enough for filing, and then, as the cut went along, I would have to hang over the lathe with the calipers in hand and keep working the elevating screw and adjusting the tool in a little or out a little to make up for the inaccuracy of the lathe, the spring of the work and the wear of the tool. After that would come the filing, and that might take considerable time. First, it would have to be gone over with the file until all the tool marks were out and then it ought to require some more filing to make the fit. You file the end first until the follower will slip on the whole length of it, and then you keep trying and filing along, getting it to go a little further every time until the follower will pass all over. Sometimes in this operation a little file dust might get in between the surfaces and cause them to "seize," and then there would be serious trouble, but when this did not occur and the follower slipped over all right, that was a "good enough" job, as done by some of the best workmen of a time not so very long ago. We were really more satisfied with the "good enough" jobs of those days than we are with any of the good enough work of to-day.

I need not describe the boring and reaming and lapping of holes to-day and the accurate and automatic turning and grinding of rods or shafts to fit them, but when we see what is done and how it is done now, it is evident enough that there is something or somebody continually shoving "good enough" along still a little while ahead of us, so that the good enough of yesterday is never and nowhere the good enough of to-day. TECUMSEH SWIFT.

Reversing a Drawing—Coppering Brass.

Editor American Machinist:

At page 497 Billy Murphy tells how he made two blades of grass grow in place of one by holding his pattern and the drawing up before the window and reversing. The scheme is good, not only for Billy Murphy but for the toolmaker and the sheet-metal worker. Frequently one drawing will be made for a piece which needs to be made right and left, or the drawing will be made without a thought of whether it is right side up or upside down. If the drawing is not as desired,

hold it against the window glass and mark the outline on the back side of the drawing or upon another sheet of paper, and then if desired the shape can be cut out with a knife or a pair of scissors.

At page 476, A. H. tells how he copper plates brass and bronze for uneven surfaces. I believe A. H. or anyone else will get a better job by applying the copper solution to the brass first and then sprinkling on the iron filings, or rubbing with a piece of bright, clean iron or steel if the surface is flat. I prefer to apply the copper solution and then rub the solution on the brass with a piece of bright, clean iron or steel.

The way I found out that copper solution would plate brass was that I happened to spill some on some iron and brass filings that were on the vise, and I noticed that both became copper color. At first I used filings the same way as A. H., but soon changed to putting on the solution and then rubbing with a piece of iron or steel. That was about ten or twelve years ago, but I have been told that someone at Brown & Sharpe's (Mr. Beales, I think) discovered it about twenty years ago.

It may not be out of place to state the reason for the plating of iron and steel by the copper solution. The crystals of vitriol or bluestone are properly sulphate of copper and are obtained by dissolving metallic copper in sulphuric acid, either dilute or full strength, and then evaporating with a gentle heat. Another way is to evaporate the water of copper mines. When used by the machinist the sulphate of copper crystals are dissolved in a bottle of water, and I usually add to a pint of solution two or three tablespoonfuls of sulphuric acid, as it helps to deposit better.

It must be remembered that the blue solution is composed of water, sulphuric acid with the copper in solution, and when the solution is applied to iron or steel the sulphuric acid, having a greater affinity for the iron than for the copper, at once combines with the iron and leaves a deposit of copper on the surface of the iron. It is possible that a feeble electric current is developed which may assist by electrolysis the depositing of the copper. In the deposition of copper on brass by using iron filings or a piece of iron the action of the sulphuric acid in combining with the iron is the same, and as there is an excess of copper some of it is painted on the surface of the brass. G. SCHNEIDER.

Special Oscillating Turning Device.

Editor American Machinist:

Referring to the article, "Special Oscillating Turning Device," by Robert J. Smith, at page 797, I beg to say that this is simply an application of a device invented and patented by the writer in 1888, a cut and description of which were published in your paper at that time. This machine is to be found in a large number of railroad, locomotive and engine building shops throughout the country, and is used for turning the pins of cast-iron or steel crossheads which are cast integral with the cross-head proper, although it is not limited to this class of work.

Mr. Smith states that his device can be readily adapted to do any turning which does not go through a complete revolution, when as a matter of fact the angle of oscillation is limited to less than 180 degrees on account of the connecting rod striking the arbor which carries the work, and also on account of the dead centers which would occur at 180 degrees. This difficulty is overcome in my machine by using, instead of the connecting rod a steel rack engaging a pinion mounted loose on a sleeve extension of the main driving pinion on the lathe spindle. To this loose pinion is fastened a chuck or face-plate and the work can be carried on the centers or on the chuck or face-plate direct.

A range of angle of oscillation of from 360 degrees (or more if desired, and if the ratio of gears will permit) to 20 degrees is obtainable, the latter angle being limited only by the center pin in the large gear.

B. J. COATES.

[Mr. Coates's device, which is similar to Mr. Smith's, was illustrated in our issue for April 14, 1888. Without having laid out the mechanism, our impression is that with Mr. Smith's arrangement a movement somewhat in excess of 180 degrees can be obtained. Independent invention of the same thing is of frequent occurrence and this is no doubt a case of that kind.—Ed.]

Good Enough.

Editor American Machinist:

It is the man who turns out the work for the lowest price per piece, whether he be owner, superintendent, foreman or workman, who "gets there." To secure the lowest piece price only such work can be put on as is necessary to reach a certain standard. More work than this is wasted; for if the standard is of any service at all, it is to fix the point at which work is good enough.

If in turning a piece to limit gages the work is brought to exactly the proper size with only one finishing cut, no more time is taken than when the size is so near the limit as only barely to pass muster, and the work is somewhat the better in the former case, though good enough in the latter; but if the size is brought just within the limits so that it will pass and then a second cut is taken to bring it to *exact* size, time is wasted, for the work was good enough before the second cut was taken.

If a piece is turned to clean up in a certain place, and if the workman goes to the trouble of setting his calipers to some even dimension, and bringing the piece to that size, just because he feels better for doing so, he wastes time and shows really bad workmanship, for the piece was good enough when cleaned to no particular size. It was all right and couldn't be made any more right by further time spent on it; and the man shows his lack of appreciation of the fact.

The workman who is told to drill "a clearance hole for a three-quarter machine bolt in the corner and about three inches from the edges" of a casting, and who carefully lays the hole out, draws a circle and prick-punches it all around, drills to the line, drawing his drill back if it runs, and even perhaps puts a small drill through first, does a mighty sight worse job than he who bats a prick-punch hole near the middle of a chalked cross and forces a 13-16 inch drill through. The latter man's work is "good enough," while the former shows lack of head.

Foremen should always remember that they know better what they will allow to pass than the workman, and that the workman would usually rather be called down for doing a job too well than not well enough. This applies in jobbing shops and places where limits are not well established, but where a good system of inspection has been in vogue for some time, a man when once accustomed to a given job should know just about what is wanted and work to strike safely within that limit and then be content to stop.

"A little knowledge is a dangerous thing," and the foregoing must be applied with some judgment. If an apprentice were allowed free scope to bring his work just within the limits supposed by him to be good enough, curious results might often follow, and it is pretty safe for anyone, whether an apprentice or a new man on a job, to be in error on the side of too good rather than too poor. A foreman who knows his business will point out the error to the man who does his work too well in a way that will promote good feeling and his opinion of the man is likely to rise; whereas, if the work is rushed through in a slovenly way, the man has little excuse, for saying that he wanted to do it cheaply doesn't carry much weight when the work has to be done over or patched up. B.

Grinding Hacksaws—Drilling Half Holes—Taper Gages—Peening.

Editor American Machinist:

At page 625 "A Sufferer" says that only the hard Griffin saws can be ground, and not the blue ones. I do not think that I have seen a hard Griffin saw for over ten years, but during that time I have ground a few saws myself, and I have had the kid grind several on different occasions. As long as a saw has a fairly good set to the teeth, and is not consumptive looking generally, I am willing to spend two or three minutes to have it ground up, as in the majority of cases it will do more work than when new, and I care not what make of saw it is. I use a beveled wheel, and it seems to me that "A Sufferer" would have a saw that would take hold better if he used a beveled instead of "any old wheel." Several years ago a correspon-

dent from down South told how he sharpened a hacksaw with a hammer, on a pinch, and it was not so bad—just broke out the teeth, which left a ragged edge, but it cut.

At page 627 A. N. Nay tells about drilling holes one-half in each piece. I would suggest that Mr. Nay keep his eye on that scheme, or some time when he is over confident, or when he is drilling in cast iron, where one side is liable to be more dense than the other, the drill may play him a prank and go in almost any old direction.

At page 629 Morris Fulton asks for a taper gage for the sketch he shows. The best all-around, universal taper gage that I know of is a micrometer caliper—that is, for an outside gage. Mr. Fulton might make a ring gage for the piece he shows, but when he changes the length or diameter or taper, he is soon in want of a new gage. With a micrometer the diameter at the shoulder and at the end can be measured, and so close as to make a pretty good fit. When the tapered piece is to be a certain number of thousandths of an inch per foot and the piece is short, then two fine lines may be scratched on at a certain distance apart, 1, 2, 3 or more inches, and the measure made and the correct proportion found, and if official refinement is required using a glass. It is possible that there is a strictly up-to-date, all-around, universal taper gage on the way; until it arrives I know of no better one than the micrometer.

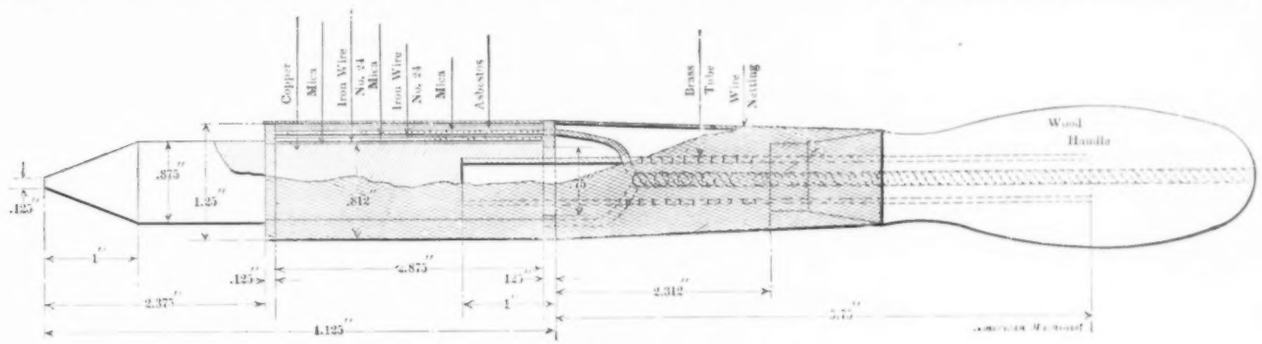
In his criticism on the subject of peening, it seems to me that Mr. Swift is a little severe on the man who invented the art of stretching metal by peening. I am aware that there are some jobs of straightening that should not be peened; but there are some jobs that peening is the most natural and satisfactory way to correct. Take for instance a 60 or 70-inch circular saw that has been run into a pine or hardwood log and been heated up and warped so as to run snaky, or one that is rim-bound or center-bound, and so almost useless. A saw hammerer is sent for, and when he comes he holds his anvil on one side of the saw and strikes the saw with his hammer on the opposite side, which peens it. If the saw is rim-bound, which will cause it to buckle in the center, then it is hammered around the rim; but if it is center-bound, then it is hammered in the center until it runs true or until the buckle is all out. If the operation of hammering a saw is not actually peening it, then it is up to me to find a dictionary that will exactly and clearly define peening.

If hammering a saw is only another name for peening, and if, as Mr. Swift says: "The man who invented peening was not much of a benefactor after all," then it will be up to Mr. Swift to inform the sawmaker, the tinner, the cornicemaker and the sheet metal worker that peening is not so very much, after all. They are all more or less guilty, and many will say that they know of no better way to make their work flat and true than by peening. G. SCHNEIDER.

An Electric Soldering Iron.

Editor American Machinist:

The common use of the electric current for lighting and motors, in workshops, makes the use of an electric soldering tool a handy convenience, far preferable to the tool of the usual style, in that the effect of the current is immediately apparent in heat generated and that it is constantly maintained. Not only do electric soldering irons save the time used in waiting for heat, but they very materially decrease the fire risks.



ELECTRIC SOLDERING IRON.

Although such tools are on the market as a regular line of manufacture, some may prefer to make their own, as it is not a difficult matter by any means. The drawing represents actual practice, although one is not strictly bound as to size.

A piece of copper rod, of suitable size and length, is the foundation. It may be turned or reduced so as to form a shoulder, midway of its length from the back, for an iron washer, and at the extreme back end further reduced for another iron washer, tight fitting, and having two small holes through it for the insulated wire, more about which further on. The back end of the copper should also be drilled out a ways to receive a brass tube, leading to the wooden handle. This tube may have a number of holes in it to allow the air to carry off some of the heat that would otherwise be transmitted to the handle, and also to permit the wires to pass out of it and through the washer. The brass tube must be solidly affixed to the copper and also into the wood, or a shaky job will result.

About the bare copper wind a sheet of mica, so as to thoroughly cover its entire surface between the washers; on this wind an open helix, or coil, of No. 24 B. & S. W. G. iron wire, from the rear towards the point of the tool, attaching to the end of the coil one of the two insulated wires entering the handle, passing through and out of the tube, through the end iron washer; then more mica covering and another coil of the same wire wound back upon the other, but separated from it by the mica, and attach the end to the other insulated wire. Over this place more mica and a sheet of asbestos to prevent the heat radiating outward. The point of the tool may be shaped as one fancies; the main thing is the thorough insulation between the two coils of iron wire and at the washers. Over the coils and extending back to the wooden handle, it is well to place a protective cover, as fine mesh wire netting, or perforated sheet metal. The ordinary covered incandescent light wires have been used, the two twisted together, forming a cable of desired length and terminating in a common lamp socket or coupling with which it should be interchangeable.

Two things about these tools the average person will not understand; one is why they are commonly called "irons," when little or no iron enters into their make-up, and the other—of more practical importance—is the gradual reduction of area near the point of the tool, while at the same time an appreciable actual *increase* takes place immediately in front of the washer nearer the point. Perhaps someone better versed in electrical matters will be able to explain. W.

Civil Service Examinations.

The U. S. Civil Service Commission, Washington, D. C., announces examinations to be held August 12-13, at places distributed through the country, for hydrographic surveyor, U. S. S. "Ranger," at $1,600 a year, and also for miscellaneous computer, Naval Observatory, at about $900 a year.

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Visitors in the Krupp Works.

The shipbuilding and engineering congress recently held in connection with the great exhibition at Düsseldorf was perhaps most notable for one of the—in a way—incidental events of the meeting. Here were gathered the men of all the civilized world (not all the men of course) most eminent and expert in the lines represented—not only Germans but engineers and scientists of all the nations most active in competition and rivalry with Germany—rivals and competitors not only in all lines of industry and commerce but also in the arts of war and in the production of armaments offensive and defensive. The event calling for remark was the throwing practically wide open of the gates of the Krupp Works at Essen, so that all might see how things are done there, and especially be inspired and quickened by the magnitude and magnificence of the plant and its operations. We have no need to remind our readers how strictly those works have been policed and how carefully their operations have been guarded heretofore. Herr Krupp has never been backward in showing the results achieved, but as to the means and methods of production apparently as little as possible has been disclosed. Now there seems to have been a new departure and a reversal of the old habit. The members of the congress, to the number of 250, were not only admitted to the works, but spent a solid day there, arriving at 9 A. M. and leaving at 7.30 P. M. The visitors were taken to the hydraulic presses and the armor plate mill, then to the open-hearth steel works, and after that to one of the large machine shops. Then the Bessemer plant and the rail mill were visited; all this before luncheon. After the luncheon there was the military section of the works, the gun shop and gun-carriage department, the crucible steel works and other departments. Then there was a practical exhibition of gunnery, showing some wonderful quick-firing, the entertainment concluding with a sumptuous dinner at which there were speeches by a representative of the works and by Lord Brassy. This program, as enumerated by *Engineering*, comprised after all only a run through the works, but to experts familiar with all the operations and keen for information it gave ample opportunity for picking up many of what would once have been regarded as trade secrets. It seems to be at last recognized, even by the Krupp Works, that there are no trade secrets, or that if there are they are not monopolized by any one concern, even the greatest, and that it is futile to attempt it. We all know that each is the richer by having all that all the others have, and that the stimulus of intercommunication of ideas is too valuable for any to ignore. The liberal policy is a distinctly American one, but we can rejoice with all the world when it is no longer exclusively ours. We do not believe that the Krupp Works can by any possibility be ultimately the losers by allowing the engineering world to see and know what they do and how they do it. The greatest works of its kind in the world is never to be beaten by imitation.

The Commercial Situation in Great Britain.

The Engineer in an editorial entitled "The Commercial Situation" invites its British readers who are "manufacturing engineers" to send in their expressions of opinions as to what should be done in view of the present situation, which it describes as most threatening to British industries.

It virtually advises the disregarding of all past experience and the principles laid down by leaders of thought in former times and says that the best course to pursue must be decided solely upon the situation as it exists to-day. Reading between the lines one can easily see that the editor favors a duty upon imports of manufactured goods and perhaps some restrictions upon the trade of foreign nations in the newly acquired South African territory. Whether such a sentiment is general among British manufacturers or not is difficult to tell, but such things are likely to be considerably discussed over there, and the discussion cannot fail to have considerable interest for American manufacturers of machinery that goes to Britain or to South Africa. The British Parliament has a way of doing things rather suddenly upon occasion and some action may be taken at any time.

A New Development in Correspondence Instruction.

A notable development in technical instruction by correspondence and an equally notable recognition by an "old line" technical institute of the merits of the correspondence system, is to be found in the new scheme of co-operation between the Armour Institute of Chicago and the American School of Correspondence of Boston.

Dr. Gunsaulus, president of the Armour Institute, will hereafter act also as the head of the Advisory Board of the American School and the faculty of the two schools are associated. All examination papers of American School students in the vicinity of Chicago now go directly to the faculty of Armour Institute. The work done by the students of the American School is formally recognized by the Armour Institute and all credits obtained for work done in the former school will count toward a degree in the latter.

The fundamental idea of the scheme seems to be that by it a student may undertake the earlier part of the work of a full engineering course of study at home under the auspices of the American School and finally complete the more technical part of his course by a comparatively brief attendance at the Institute.

The idea is also advanced by the sponsors of the new arrangement that the in-

creased earning power due to acquirements obtained from the American School will enable students to support themselves while attending the evening classes at the Institute or to accumulate sufficient funds to enter the regular day classes there.

The courses of the Institute include mechanical, electrical, civil, chemical and architectural engineering, each leading to the degree of Bachelor of Science. It is well recognized as being in the front rank of engineering schools and this arrangement will no doubt place its facilities within the reach of many who are now denied them.

It is altogether possible that this experiment may be attended with important results and we shall watch its progress with interest.

The Allis Engines in Glasgow.

It will be recalled that some time ago we referred to the obviously unfair criticisms being made by British journals upon the Allis engines that were installed last year in the power-house of the Tramways Department of the Glasgow Corporation. Seldom if ever have engines built anywhere attracted more attention and comment, many engineers and journalists in Britain seeming to think that if they could only keep up a sufficient noise about it the engines would prove a failure anyhow. The engines themselves, however, have steadily disregarded this application of what might be called "adverse suggestion" and have gone on supplying the energy for moving Glasgow's tramcars, as though they had never been expected to do anything else. The final triumph of the builders seems now to have been attained, as shown by the publication in *Power* for July of the following telegram from H. F. Parshall, M. Inst. C. E., and a well-known consulting engineer of London:

Edwin Reynolds, Esq., Chief Engineer,
The Allis-Chalmers Co., Milwaukee, Wis.

Dear Sir: Having regard to the great amount of discussion there has been in this country as to the design and merits of the two 4,000 horse-power engines which you supplied to the Tramways Departm nt of the Glasgow Corporation, you will, I think, be interested to know that they have been tested by Prof. Barr, a disinterested expert, and found to give exceptionally good results. The consumption of steam per I. H. P. as measured by the condensed water was found to be 12.2 and the mechanical efficiency of the engines 96 per cent. Your engines are direct connected to G. E. 2,500 K. W. triphase machines, and the combined efficiency, that is the ratio of the I. H. P. to the E. H. P. output was 92 per cent. The engines are working perfectly well in all respects, and have been from the beginning.

Yours faithfully,
(Signed) H. F. PARSHALL.

Another point about this is the dignified and altogether commendable way in which the Allis-Chalmers Company has made use of this telegram. They have taken two facing pages in the advertising part of our contemporary, printed the telegram on one page with a picture of the engines on the other, and allowed these to tell their own tale, which they do far more effectively than they would have done had there been an attempt made to "work the press", after the manner of those who send out one-sided and generally grossly unfair statements about some court decision in a patent case and then grow wrathful because ye discriminating editor declines to print them.

The Glasgow Allis engines are doing all right. We are glad of it; and the more glad because all through the storm of abuse and denunciation that has been heaped upon them the builders have remained calm and have pursued a perfectly dignified course.

By the way, the figures given in that telegram taken in connection with the statement that *"the engines are working all right and have been from the beginning"* are worth careful attention. We commend them to the attention of some of those who have been endangering their vocal apparatus by their "howling" about going abroad and buying engines that could not do the work, don't you know.

The Situation in Worcester.

There seems to be no new development in the machinists' strike this week. Both sides are keeping quiet and the field of conflict seems to have been transferred to the wood-working shops, where the machine carpenters have been out for some time and are putting up a fight on practically the same grounds as the machinists. It is stated that quite a number of the the striking machinists have returned to work in their old places, but there has been nothing like a stampede in that direction thus far. O.

Worcester, June 28.

Notable Cable Construction Nearly Completed.

There were recently completed some interesting operations in the construction of the new East River Bridge between New York and Brooklyn, known at present as "No. 2 Bridge." The cables are being constructed by John Roeblings' Sons, of Trenton, N. J., under the direction of their engineer, Mr. William Hildenbrand, who constructed the cables for the present New York and Brooklyn Bridge and also the recently added cables for the Cincinnati Suspension Bridge. The cables of the bridge now being built are made of No. 6 steel wire, 0.192 inch diameter, each wire having a tensile strength, according to specifications, of 5,790 pounds, which is equivalent to the very high tensile strength of 200,000 pounds per square inch; actual tests of the wire showing that that which is going into the cables will stand a stress of from 210,000 to 220,000 pounds per square inch. There are four of these cables, each composed of thirty-seven strands, which are laid parallel and afterward bound together, each strand being composed of 208 wires, which are also laid parallel and afterward bound together. Thus the total strength of each strand is 1,204,320 pounds, and of each cable 22,279 tons.

The wire came from the Trenton factory of the makers on reels, each containing 4 tons, and when the work was in full swing about 48 to 50 tons of it were being stretched across the river every day. Each strand of wire from anchorage to anchorage weighs about 600 pounds, the distance being 3,000 feet. The traveling wheels which carry the wire moved from one anchorage to the other in about 8 minutes, the total time of moving across, making the necessary changes at the end and back again being about 20 minutes; each round trip of each traveling wheel and adding four wires to the cables. This was accomplished by a small traveling cable driven by a stationary engine on the New York side of the bridge, which engine, by suitable gearing, was made to drive in either direction sheave wheels around which the traveling cable was wound. The traveling wheels were attached to this cable by a frame clamped to the cable and the end of the wire, being attached at one anchorage, the wheel started from the same anchorage and carried the bight of wire across the bridge to the other anchorage; thus below the wheel there was a standing wire—*i. e.*, one which did not move—and above it one moving at twice the speed of the wheel, so that at each passage of the wheel across the bridge two wires were added to the strand.

This is the same method as was pursued in the present East River Bridge, but in that bridge the wheel, after carrying across a bight of the wire, returned empty, whereas in the latest system each wheel when it arrived at the end of the bridge was transferred to another strand and carried a wire from a different reel back to the other side so that each wheel did useful work in both directions instead of traveling idle half the time. The engine for doing this work was a 12x14, 60 horse-power, using steam at 85 pounds pressure.

The wire is drawn at the mills in lengths of about 3,000 feet, and these are joined together by a right and left hand threaded coupling, the ends of the wires being beveled in such a way that when they come together in the center they lock together, so that the wires cannot be separated except by turning the coupling, holding both wires still.

It now remains only to bind the several strands together to form the completed cables, of which there are four, and the work of attaching the suspenders will then be done; after which another contractor will build the "superstructure."

In the construction of these cables Mr. Hildenbrand used foot bridges for the first

time. Ordinary cables were dragged across the river, hoisted to the tops of the towers and secured. These supported foot bridges which followed the line of the cables from anchorage to anchorage and on which the men worked in security and relative comfort.

Technical Publications.

"Section A of the Mechanical Index. Machine Tools and Metal Working Machinery. Small Tools and Accessories." 136 6x9-inch pages, paper bound. $1.00. The Industrial Press, New York.

In our own business we have found trade directories, etc., to be generally unsatisfactory. Most of them are not conscientiously gotten up and the few that are intended to be complete are not really so, either because names are overlooked or because as soon as such a directory is ready for the press it begins to be out of date. We, in this office, do a great deal of searching after names of makers of machinery of all kinds, and when our card index does not give us the desired information we go to the advertising pages of our contemporaries that are the leading publications in their various lines of trade. There we find practically all the names of those who are really alive and wish to do business, or with whom it is worth while for an inquirer to correspond. This experience has possibly prejudiced us a little, but, however that may be, it has caused us to scrutinize for a few minutes this new directory, which pertains especially to our line, and with the result that we consider it better than most such directories are. The general alphabetical index to tools and appliances is in English, German and Spanish, but by the arrangement chosen only the English words are arranged in alphabetical order, so that a German or a Spanish-speaking person has no alphabetical index to which he can refer. Glancing through the pages we note that in the list of makers of gear-cutting machines the name of Wm. Sellers & Co. does not appear, although they have built them for years and their automatic gear cutter was one of the first, if not the first, to be produced. Among the makers of universal milling machines the names of the Kempsmith Manufacturing Company, Kearney & Trecker and the Cincinnati Milling Machine Company do not appear, while the names of the Newton Machine Tool Company and the Pratt & Whitney Company do appear, the two last named not being in fact builders of universal millers. In the list of makers of rack cutting machines the name of Fellows does not appear, and under "Shaping Machines, Gear," the Putnam Machine Company and the Springfield Machine Tool Company are put down with the Fellows Gear Shaper Company as makers of gear shapers "producing theoretically correct gear teeth," etc. These glaring omissions and errors, found by a few minutes' examination, are sufficient to show, not that the directory has *no* value, but that, like all the rest of them, it will not do to depend upon it where one wishes to be sure that inquiries or letters are addressed to all the manufacturers in a given line or even to all the more prominent ones. The only trade directory we would trust would be one we made ourselves—and we wouldn't trust that very far or very long.

A friend wishes the address of Clarence D. Michener, who was at one time in Toughkenamon, Pa., and afterward worked in the shops of the Brown & Sharpe Manufacturing Company.

Jones & Laughlin, of Pittsburgh, recently advanced wages of all their employees except the tonnage men, the increase affecting something over 3,000 men and being an average increase of about 10 per cent.

It has been announced that 15,000 employees of the United States Steel Corporation will receive an increase of wages amounting to about 10 per cent. The men are employed at various mills owned by the company. The increase includes both skilled and unskilled men, and the men were given no previous notice of the increase.

In the Australian House of Representatives an amendment to the Customs Bill has been introduced which is intended to enable the authorities to deal with trusts in the manner that has been proposed here; that is, upon proof that a trust exists in any line of trade, which trust has established a monopoly, it is to be made within the power of a government official to declare goods similar to those made by the trust to be free of all import duties.

The "Kroonland," which is a new steamer of the Red Star Line, intended to be used in the service between New York and Antwerp, has been put into service and sailed from New York on June 28. The "Kroonland" is the largest ship ever built in the United States. She is 580 feet long, or 26 feet longer than the "St. Louis" and "St. Paul," and has a registered tonnage of 12,000 tons, which is 400 tons more than those vessels. She was built at Cramp's.

The Machinists' Co-operative Association is being organized in Brooklyn, N. Y., with John W. Wilson, president, and A. M. Purdy, secretary. In a prospectus issued by the association, it is set forth that the recent large aggregations of capital in manufacturing enterprises have made it imperative for workmen to get together and form their own companies. It is believed that such a co-operative society can be made successful, and the society has been offered a good specialty to manufacture on royalty—a thing which has been introduced and for which there is a market. The success of other co-operative associations, especially those of England, is referred to, and it is stated that the constitution of the association provides that two-thirds of the members shall be members of the International Association of Machinists. The other third may come from other vocations, though whether it is required that they also be members of a trade union or not is not stated. The admission fee is $1.00, the dues $6.00 per annum, and shares in the association are $5.00 each. Full particulars may be obtained by addressing the secretary named above, whose address is Corner of Court and Sackett streets, Brooklyn, N. Y.

A strike of machinists employed by the Union Pacific Railroad Company has taken place. It is understood that friction has been manifest for some time, some men having been discharged whom the union claims would not have been discharged had they not been prominent or active members of the union. The strike is for 10 per cent. increase of wages, the reinstatement of the discharged men referred to and for the abolition of piece work. The railroad officials say that it is the settled policy of the company to introduce piece work and that they propose to do it, while the men declare that they will not work piece work.

Personal.

R. C. Wright, salesman in the employ of the Garvin Machine Company, of New York city, is now located in Syracuse, N. Y., in the company's interest.

Frank A. Seeger has gone from Waterloo, Iowa, to Beaumont, Tex., to take the position of machine foreman of the Southern Car Manufacturing & Supply Company.

W. D. Woolson, treasurer of the Jones & Lamson Machine Company, Springfield, Vt., is about on the point of sailing for Europe, where he will visit most of the leading countries and look after the company's foreign business.

J. L. Osgood, mechanical engineer, resigned his position as manager of the Pratt & Whitney Company's Buffalo branch early in the year and has since engaged in the machinery business on his own account, with offices at 131 Erie County Bank Building, Buffalo, N. Y., with storerooms at Wells and Seneca streets.

Obituary.

Charles Tripler Child, technical editor of the *Electrical Review*, of this city, died June 23, thirty-five years old. He was born in Richmond, Va., and was a graduate of Johns Hopkins University. He was a man of unusual ability and of actual achievement. He spoke and wrote seven languages and was widely known for his contributions on electrical and scientific

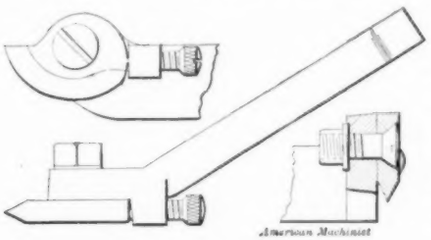
subjects. He was also a most practical electrical engineer, having upon his graduation entered the employ of the Sprague Electric Motor Company and taken part in the installation of the pioneer electric railway. In Kansas City he had learned all the details of electric lighting. From 1892 to 1895 he was in charge of the astrophysical observatory of the Smithsonian Institution. In 1899 he became technical editor of the *Electrical Review*, which position he held at the time of his death, which resulted from typhoid fever.

Prof. R. B. Johnson, dean of the College of Engineering of the University of Wisconsin was killed, June 23, by a shocking accident at his summer home at Pier Cove, Mich. He was driving a wagon carrying some of his household goods when he fell off and a wheel crushed his head. Dean Johnson was born at Marlboro, Ohio, in 1850, wa graduated from the University of Michigan in 1878, and was then employed on the Great Lakes and Mississippi River survey. He then assumed a professorship in the Washington University of St. Louis, remaining there fifteen years, when he went to the University of Wisconsin, becoming dean of the College of Engineering at the beginning of 1899. He was very successful th re, promoting the rapid growth of the institution and especially his department of it. Dean Johnson w s the author of a large number of important works and was a constant contributor to technical journals and to the proceedings of engineering societies. He was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Institute of Civil Engineers, England, and of numerous other societies. He was a member of the committee planning the institute which Mr. Carnegie is to establish in Pittsburgh, and most of the actual work it is understood had fallen upon his shoul ers.

Some New Things.

IMPROVED LATHE TOOL.

The cut, from a recent patent, shows a new form of lathe tool with renewable cutter. The cutting point, it will be seen,



A REMOVABLE SCREW-THREADING TOOL.

can be ground back as often as necessary and still retain its proper shape and clearance, being held securely by the central bolt and the set-screw. The surface against which the point of the screw bears is concentric with the center bolt, while the cutting shape is upon a constantly receding curve. The Armstrong Bros. Tool Company, Chicago, is the patentee.

Commercial Review.

NEW YORK, Monday, June 30.

MISCELLANEOUS TRADE NOTES.

We mentioned last week that a representative New York machine-tool house reported June orders lighter than previously. Subsequently it has noticed a revival, the last week being the best of the month. No opinion is given whether this represents a rush to cover on the part of buyers. It is of interest to note that another well-known concern regards the closing week of the month as the slackest. This sort of a see-saw is frequently met with in the machinery market. In regard to prices, there is a sympathetic upward movement in lines not covered by the recent advance on lathes.

"I have not a buyer who is not begging me to anticipate shipments." So remarked a leading New York pig-iron broker two or three days ago. His business, by the way, about all comes from the foundries —a characteristic of pig-iron trade in this market.

The growth of the gas-engine trade is illustrated by the fact that a large general supply house of New York city, which took up stationary gas engines somewhat more than a year ago, is doing double the business it expected to. Its sales are averaging about five a week.

In the twist-drill line among others there is still more or less complaint about difficulty in getting goods from factory. One prominent company in that line, which, although exceedingly busy, is able to make prompt shipments on most of its goods, is somewhat crowded in the line of reamers, particularly special ones.

The Jones & Lamson Machine Company, of Springfield, Vt., state that business is very brisk and they have not felt any slack-up in orders as yet on account of the usual summer dullness. Their business has increased so that they have now in course of construction a large three-story fireproof addition to their plant, which will double their capacity, and are also building a new power-house.

It is encouraging to note quite a little spurt of building activity among Cincinnati tool manufacturers. The Cincinnati Shaper Company will put up a factory building at Garrard and Elmore streets, Camp Washington, of brick and steel, two stories, three-bay type, 292 by about 92 feet, and a power house for which an engine and boiler have been purchased. The Rahn-Mayer-Carpenter Company will erect an ironclad building, 50x50 feet, on Spring Grove avenue, near Beard. The A. Streit Machine Company is preparing to build at the southeast corner of Comfort and Marquis streets, Camp Washington. The R. K. LeBlond Machine Tool Company, as noted last week, is putting on an extension for a new engine and blacksmith shop.

Robert McF. Doble, Hayward Building, San Francisco, consulting engineer of the Guanajuato Power and Electric Company, of Mexico, was to leave for New York a few days ago, intending to visit the works of the General Electric Company to complete the details of an order placed for a 6,000 horse-power electric power plant. The current is to be transmitted 110 miles from the Duero river, where it is to be generated under a head of 330 feet. A number of mining properties will be supplied with power.

Charles R. Huntley, of Buffalo, vice-president and general manager of the Cataract Power & Conduit Company, of that city, says that shortly after 1904 there will probably be a demand for 200,000 horse-power in addition to the 300,000 horse-power now in sight from Niagara Falls. This is under the assumption that present industrial conditions are fairly well kept up, although not absolutely equal to what they are to-day. The Falls Power Company has a plant generating 50,000 horse-power and is doubling it, while the Canada Power Company is building another 100,000 horse-power plant, and the Albright Company plant in Buffalo that will supply elctric power to the Lackawanna Steel Company at Stony Point will, it is reported, generate 100,000 horse-power.

The Link-Belt Engineering Company, Philadelphia, has just sold four 100 horse-power chain drives, one for Harrison Safety Boiler Works, Philadelphia, to drive a dynamo; two to the Acker Process Company, Niagara Falls, to drive blowers, and one to the Camden Iron Works, Camden, N. J., to drive a centrifugal pump. They have also sold eight 30 horse-power, three 20 horse-power and one 5 horse-power chain drives to the Buffalo Forge Company for the heating and ventilating plants of the new Reading Railroad shops, Reading, Pa. They have also sold a set of drives from motors to line shafts for the monotype building of Wm. Sellers & Co., for Lunkenheimer shops in Cincinnati, for Pennsylvania Steel Company, Steelton, Pa., and for the Lake Shore & Michigan Southern shops, Cleveland.

The Cleveland (O.) Pneumatic Tool Company is experiencing the heavy trade prevalent in its line of appliances and is unable to keep up with orders in its present shop space. The company writes us that it has therefore purchased land on Hawthorn and Second avenues and will at once begin the erection of modern factory buildings which, it hopes, will enable it to serve its trade more promptly than at present. It will employ 150 men upon completion of the new plant.

The American Steel Foundries has been organized under the laws of New Jersey, with an authorized capital of $20,000,000 preferred and $20,000,000 common stock. This company expects to acquire the plants

and properties of the American Steel Castings Company, of New Jersey; Reliance Steel Castings Company, Limited, of Pittsburgh, Pa.; Leighton & Howard Steel Company, of St. Louis, Mo.; Franklin Steel Casting Company, of Franklin, Pa.; The Sargent Company, of Chicago, Ill., and American Steel Foundry Company, of St. Louis, Mo. C. M. Schwab, E. H. Gary and Max Pam are interested in the deal.

A new plant of some importance in the power line which is about to go up in this vicinity is that of the National Water Tube Boiler Company, New Brunswick, N. J. We give further particulars in our "Manufacturers'" column.

The Freight Classification Committee of the Western railroads will meet at Charlevoix, Mich., on July 15, to consider various petitions for changes in the present classification schedules. Among the points to be discussed will be the change of emery wheels from second to fourth class.

It is stated by a man who is somewhat closely in touch with affairs at Pittsfield, Mass., that the Stanley Electric Manufacturing Company, which has lately been acquired by Whitney-Widener-Elkins interests, has secured additional land there. It looks as if the reported enlargement of the company's scope to supply the syndicate's traction interests in New York and elsewhere were grounded in fact. An interesting rumor is to the effect that the amount of business which the General Electric and Westinghouse Electric companies have of late been getting from the interests which may now be supplied by the Stanley company has amounted to 37 per cent. of the total trade of those two large concerns. This would mean not far short of $20,000,000 a year. We have serious doubts as to the accuracy of the figures or whether the Stanley company could be equipped to handle this trade satisfactorily for many a long day.

There is quite a little ferment taking place in the roller and ball bearing line. The Steamobile Company, Keene, N. H., has sold its plant to the Standard Roller Bearing Company, of Philadelphia, which is said to have recently purchased and consolidated several roller bearing companies and to be building a big manufactory in Philadelphia. It is believed that the Standard Company will eventually move the roller bearing business it has acquired in Keene to Philadelphia. On the other hand, W. S. Rogers, who has been with the Steamobile Company, is now president and general manager of the Ball Bearing Company (of Maine), with an office at Keene, N. H. He announces that "W. S. Rogers will be hustling as lively as ever within sixty days with a line of anti-friction bearings, both ball and roller end thrusts of still better quality and at lower prices than in the past." E. B. Cadwell, president of the Standard Anti-Friction Company of New York, has become a director and treasurer of the Ball Bearing Company (of Maine). We understand that the consolidation of the two latter concerns is likely to be brought about and the manufacturing business possibly concentrated in Keene.

Pawling & Harnischfeger, Milwaukee, Wis., state that the demand for electric cranes and hoists remains highly satisfactory and that they are at present booking orders for one crane per day on the average. There is a noticeable broadening of inquiries, particularly from the Central and Western States, and the prospect for sales in these sections looks very good. The foreign demand is bettering, judging by the inquiries within the last month. Prominent among recent buyers are the following: Grand Crossing Tack Company, Chicago, one 75-ton ladle crane with 25-ton auxiliary trolley; Westinghouse Machine Company, one 10-ton crane; Bethlehem Steel Company, one 30-ton crane with 10-ton auxiliary trolley, and three 2-ton chain block cranes; The A. & F. Brown Company, Elizabethport, N. J., one 15-ton crane with 3½-ton auxiliary hoist; Buffalo Foundry Company, Buffalo, N. Y., two 30-ton cranes with 5-ton auxiliary hoist and four 10-ton cranes; Ball Engine Company, Erie, Pa., one 25-ton crane with 5-ton auxiliary hoist.

A leading Australian paper is authority for the statement that a company having a capital of £730,000 has been formed in London to acquire the extensive iron works of John Sandford & Co., at Lithgow, New South Wales. The new company has given orders for two blast furnaces, steel furnaces, and rail and plate mills. It is anticipated that the immense iron deposits known to exist in the States of New South Wales, Victoria and Tasmania will be developed and the iron and steel industry established on a large scale.

CHICAGO MACHINERY MARKET.

A few days ago the transfer of the land upon which the Chicago City Railway Company expects to erect its central power plant was made public. According to the prepared plans, there is provision for an engine capacity of about 80,000 horsepower. But the announcement means nothing for the immediate future. Contracts for the power and other machinery will not be let until the franchise question, now pending with the municipal authorities, is settled favorably to the company. Except the proposed plant of the Chicago Edison Company, to which reference was made a month ago, this is believed to be the largest power plant under contemplation in the West at the present time. There is a steady inquiry for engines and boilers for electrical street railway work.

But in the way of large power units the steel interests are now among the most persistent inquirers. The builder who could put up a large blowing engine in four or five months, instead of the fifteen to eighteen months which builders now require, would have all the business he could care for for some time. There is an excellent inquiry. Among contracts of this character recently closed were eight blowing engines for the American Steel & Wire Company, Worcester, Mass., the contract being secured by the Allis-Chalmers Company, and one blowing engine for the Buffalo Union Furnace Company, Buffalo, N. Y. The pressure to increase the production of iron and steel is severe and in striking contrast with this eagerness are the delays in completing work, an instance of which is the recent announcement of Chairman Osgood of the Colorado Fuel & Iron Company, the new furnaces and mills of which have been delayed more than a year by the backwardness of contractors, who impute the delays to makers of machinery and material.

There is also continued good inquiry for power from manufacturers. The Studebaker Bros. Manufacturing Company has bought an 800 horse-power direct-connected engine for its South Bend (Ind.) shops. For the smaller engines and boilers there is less vim in trading than there was a month or two ago. And among prospective buyers, whose projects are not far advanced, there is also an inclination to go a little slow, possibly due to the labor situation. But the large makers of power and other heavy machinery are not gaining on their orders. They are in fact rarely keeping even with the situation. Notwithstanding the heavy increase in manufacturing facilities and the heavier output, it now requires a longer time in which to secure the delivery of a large unit than it did a few or many months ago. But boilermakers are, in some instances at least, gaining on their orders.

Quotations.

NEW YORK, Monday, June 30.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$22 15 @ $22 65
No. 2 X	21 65 @ 22 15
No. 2 plain	21 15 @ 21 65
Gray forge	20 65 @ 21 15

Alabama Pig, New York delivery:

No. 1 foundry, or soft	22 25 @ 22 75
No. 2 foundry, or soft	21 75 @ 22 25
No. 3 foundry	21 25 @ 21 75
Foundry forge, or No. 4	20 25 @ 20 75

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93 @ 2.10c. in carload lots. Smaller quantities from store, 2.15c. upward.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—Base sizes—From store, 2¾c.

Copper—Lake Superior ingot, 12¼ @ 12½c.; electrolytic, 12.10c.; casting, 12c. This is an attempt to harmonize somewhat conflicting reports.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, about 28c.

Pig Lead—4⅛c., in 50-ton lots.

Spelter—New York delivery, 5 @ 5¼c.

Antimony—Cookson's, 10½c.; Hallett's, 8⅛ @ 8½c.

Lard Oil—Prime City, 79 @ 84c., in wholesale quantities.

Manufacturers.

A new sawmill is to be erected at Silverton, Ore., by Mr. Leichty.

S. Early and P. Rasmussen will erect a shingle mill at Wabash, Wash.

R. A. Millick, of Osceola, Nev., will put up a steam plant to run his stamp mill.

The Western Pulp & Lumber Company intends to erect a mill at Savona, B. C.

The American Go-Cart Company, Detroit, Mich., intends to build a new factory.

The building of the Criterion Knitting Company, Lowell, Mass., has been burned.

The Singer Manufacturing Company's Canadian factory has been damaged by fire.

Fire has destroyed the large hat factory of F. Berg & Co., at Orange Valley, N. J.

The sawmill of the Kellogg Mill Company, Ballard, Wash., has been destroyed by fire.

Plans are being revised for an addition to the Victoria Plush Mills at Swarthmore, Pa.

The Water Company at Fullerton, Cal., will build a machine shop adjoining their works.

Brigham, Utah, has voted to build a municipal electric lighting plant at a cost of $30,000.

The Eaton-Hurlbut Paper Company, Pittsfield, Mass., has had plans prepared for a new building.

The William Penn Company, Independence, Cal., is thinking of installing an electric power plant.

Frank Hutchins, of Wolfeborough Falls, N. H., contemplates erecting a woolen factory run by water.

S. Bent & Bros., chain manufacturers, Gardner, Mass., are arranging for a new building at their plant.

An addition, 200x150 feet, is to be erected at the Waterbury Brass Company's plant, Waterbury, Conn.

The sawmill at Elcho, Wis., belonging to the G. W. Jones Lumber Company, of Appleton, has been burned.

Ballard, Wash., has voted in favor of bonding the city to the amount of $25,000 for an electric lighting plant.

The Marietta (Ga.) electric light plant has been sold to Moultrie M. Sessions, of that place, who will enlarge it.

Mayor McCullough, of Swedesboro, N. J., is in communication with a firm who wants 15 acres for an iron works.

Arrangements are being made for the purchase of new machinery for the Del Monte mine, at Groveland, Cal.

The Pomeroy Brothers and others are preparing to put up a cotton mill on the Haw River, near Graham, N. C.

H. L. Frank will put in an electric power plant at Frank, Mont., to light the town and furnish power for the mines.

The American Can Company, 11 Broadway, New York, plans to erect a five-story, 81x105-foot factory in Brooklyn.

W. M. Parker, of the Parker Iron Works, San Bernardino, Cal., has perfected an ice machine to be operated by gas.

It is announced from Astoria, Ore., that the Universal Sash & Lumber Company will erect a new sawmill at Smith's Point, Ore.

It is announced from Cottrell, Ore., that Groves & Yokers, whose sawmill was recently destroyed by fire, will rebuild at once.

An addition is to be built to the plant of the Pennsylvania Steel Company, at Steelton, Pa. It will be three stories, 118x59 feet.

The output of the Shenango Pottery Company, New Castle, Pa., will be almost doubled through additions to be made to the plant.

The Wilson Boiler Company has taken out a permit for a $6,000 boiler factory building at Nineteenth and Pierce streets, Omaha, Neb.

Mr. Nichols, president of the Birmingham Drop Forge Company, has secured a site for the plant of the drop forge works near Ensley, Ala.

The Boothe-Kelly Lumber Company, of Eugene and Springfield, Ore., will erect a mill at Springfield with daily capacity of 200,000 feet.

From Spokane, Wash., it is announced that the Chewelah Lumber Company is preparing to construct a mill with capacity of 40,000 feet daily.

The Improved Buggy Wrench Company, of Anaheim, Cal., will increase the capacity of its plant. L. E. Miller is president; R. M. Bird, secretary.

A new cyanide plant is to be built this fall by the De La Mar Mining Company at a cost of $120,000. Address Doble Post Office, San Bernardino, Cal.

It is reported that two furnaces and a steel plant will be erected by the Messrs. Schuler, within two miles of Ensley, Ala., and close to Dolomite.

The Eureka (Cal.) Lighting Company (main office, San Francisco) has lost twelve dynamos by fire. Loss is about $40,000. The plant will be rebuilt.

The W. R. Trigg Company, shipbuilder, Richmond, Va., has placed a new $1,000,000 mortgage on the property on account of extensive improvements.

The town trustees at Corona, Cal., are considering calling an election to vote on the issuance of $20,000 in bonds for a municipal electric lighting plant.

The Patentees Manufacturing Company (C. W. Corliss, president) will erect a factory at Seattle, Wash., for the manufacture of automatic self-locking step-ladders.

The Logan (Utah) City Council has called a special election for July 11 to decide upon the question of bonding the city for $65,000 for municipal lighting purposes.

The contract has been let for the first building of the proposed additions to the plant of the H. Mueller Manufacturing Company, water and gas specialties, Decatur, Ill.

The $3,000,000 plant of the Glucose Antitrust Company, headed by C. M. Warner, of Syracuse, N. Y., will, it is said, be built either in South Chicago or Waukegan, Ill.

Plans have been filed with the Bureau of Building Inspection in Philadelphia for a building, 93x50 feet, with a wing 60x22 feet, for Smith, Drum & Co., machinists.

A building permit has been issued for a foundry addition to the Pratt & Whitney Company's plant, Hartford, Conn. The structure will be of brick, 68.6x57.6 feet, one story.

The Union ore sampling works, Denver, Colo., owned by the Union Ore Extraction & Reduction Company, which has an office at 828 Equitable Building, Denver, have been burned.

The name of the Webb C. Ball Company, Cleveland, O., has been changed to the Webb C. Ball Watch Company. It may in the near future erect a factory for the manufacture of watches.

Eugene Ring, superintendent of the Nugget Gulch Mining Company at Sheridan, Mont., says a concentrating plant will be put up this summer and the mine will be equipped with machinery.

Chas. F. Miller, of Golconda, Nev., general manager of the I. L. Keefe Mining Company, says he will equip the property in Elko County with a gasoline hoist and concentrating plant this summer.

The works of the Hoffman Hinge & Foundry Company, Cleveland, O., have suffered damage by fire estimated at $10,000. The engine was damaged beyond repair. The foundry is in working order.

Plans have been made for a new 50x150-foot, two story and basement factory for Dodge Bros., machinists and manufacturers of special machinery, now located at 133 Beaubien street, Detroit, Mich.

The Soda Manufacturing Company, operating at the wells near Green River, Wyo., has made an appropriation of $50,000 for the purchase of machinery and the erection of buildings to increase the plant's capacity.

Fire which broke out in the Phoenix Iron Works, formerly the Wolff & Sowicker plant, Portland, Ore., did a good deal of damage, including the destruction of machinery at the yard of the J. H. Johnston Shipbuilding Company.

Architects Kastler & Hunter, Detroit, Mich., have prepared plans for a starch manufacturing plant for the Pacific Starch Company, to be erected at Tacoma, Wash. There will be a manufacturing building, warehouse and powerhouse.

Dr. A. J. Chandler, of Mesa City, Ariz., proposes to interest capital in the construction of a big water power electric plant 60 miles from Williams. The intention is to furnish power for Prescott, Jerome, Phoenix and the intervening cities.

Matthew J. Dolphin, of the Hey-Dolphin Stamp Canceling Machine Company, has bought a building in Syracuse, N. Y., with the plan of eventually remodeling it into a branch of the main factory, which is said to be located in Brooklyn.

The plant of the National Rolling Mill Company, built at Hartford City, Ind., about a year ago, is to be greatly enlarged. The company intends manufacturing its own gas and doing its own electric lighting. Two new furnaces will be installed.

L. F. Smith and W. W. Phels, of Los Angeles, Cal., have bought the Night Hawk mine, near Kingman, Ariz. New machinery will be installed and a big hoisting plant erected. A. J. Doran, of Prescott, Ariz., has been appointed superintendent.

It is reported from Los Angeles, Cal., that the Western Power Company has begun active work on its electric transmission system. This involves the diversion and storage of the north fork of Feather River. J. M. Howells, manager and consulting engineer.

Additions are planned for at the plant of Henry A. Hiltner's Sons, scrap iron, etc., Philadelphia, Pa. Among the buildings will be a two-story boiler-house, 154x90 feet; a two-story storage shed and machine shop, 84x375 feet, equipped with a traveling crane.

Plans have been perfected by the Riter-Conley Manufacturing Company, Pittsburgh, Pa., for the establishment at its new Leetsdale works of a plant for building steel seagoing barges and tank steamers. Yards at tidewater will be established by the company for the construction of those barges which are too large to float down the Ohio.

Work will shortly begin on the erection of

the plant of the Birmingham (Ala.) Drop Forge & Edge Tool Company at 'Possum Valley, which is one-half mile south of Wylam, and on the lines of the Birmingham Mineral and the Southern Railway. The secretary and treasurer is A. E. DeFuniak, of Ensley, Ala. The company will manufacture anything from a razor to an axe. About 100 men will be employed.

It is stated in industrial circles at Birmingham, Ala., that the project of the American Car & Foundry Company to build a steel car plant there will be carried out, beginning next fall. The plant is to have a capacity of forty cars a day and to employ about 2,500 men.

A company is being organized at Stockton, Cal., to manufacture paving brick from asphalt obtained in refining petroleum at the Davis Distilling Company's plant. Mr. Davis, the inventor of the appliance, will construct a machine with a capacity of 50,000 bricks per day.

The Kramer Wagon Company, of Oil City, Pa., has purchased 7,500 acres of land in Bledsoe County, Tenn., and will erect a factory at some point not yet determined upon, to make spokes for its Pennsylvania establishment. Sawmills will be erected at once on the property.

Planters have determined to establish a cotton oil mill at Longbridge, La. The concern will be called the Longbridge Cotton Seed Oil Company. A construction committee has been appointed, consisting of Oscar Bordelon, L. L. Bordelon, B. B. Joffrion, T. A. Lemoine and O. Coco.

The Pacific Light & Power Company is preparing to build a new plant on Third and Los Angeles streets, Los Angeles, Cal. The new boiler will be capable of developing 2,500 horse-power. Oil will be used for fuel. Current will be generated for 20,000 16 candle-power lamps.

The Henry Roever Company, capitalized at $300,000, will establish a plant at Chester, Pa. It will manufacture crude and refined glycerine for soaps and toilet articles. The company will include these local capitalists: Senator W. C. Sproul, District Attorney J. C. Smith, *et al.*

The building contract has been awarded, at about $15,000, for a new building for the George W. Heartley machine establishment, manufacturer of special tools, machinery, etc., Toledo, O. An old building also will be remodeled and both buildings will be occupied by the company.

Plans are under consideration for the establishment in Toledo, O., of a plant for the manufacture of the output of the Perry Victory Machine Company, including a road scraper, a ditch digger, a plow and a potato digger. These are now made by contract at Martin's Ferry, O. The company's main office has been established at Detroit, Mich.

In the item on page 942, referring to the proposed new buildings at the Perth Amboy, N. J., plant of the Standard Underground Cable Company, of Pittsburgh, it was stated that one of these would be for the manufacture of rubber covered wire and cable. This should have read "weather proof" wire and cables. The company has already very large and complete factories engaged in the manufacture of rubber covered wire and cables.

The National Water Tube Boiler Company, New Brunswick, N. J., has recently purchased a plot of seven acres on the main line of the Pennsylvania Railroad, on the outskirts of that city, and the contract for the new buildings to be placed thereon has been let. The plans are drawn by George K. Parsell, architect, New Brunswick, and call for a brick and mill construction building, 246 x about 90 feet, and a pattern storage and pattern shop, 45x60 feet, brick and mill construction, two stories high; also an office building, two stories high, with drafting room on second floor; the general and executive offices on the ground floor. The contract calls for the buildings to be up and ready for occupancy by October 15. The general contractor is the H. Wales Lines Company, of Meriden, Conn.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Stamping dies. Emmons Collins, Chicago.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Fine machine and experimental work. The Des Jardins Type Justifier Co., Hartford, Ct.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Light machine & experimental work; models made. S. Messerer, 15 Springf. av., Newark, N.J.

Will sell patented machinists' instrument of unusual merit. Morris Chamberlain, Bartley, N. J.

Fine and special machinery and experimental work guaranteed. Wyland Mfg. Co., Williamsport, Pa.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Mechanical engineer, with offices in Philadelphia, will represent to the Eastern trade meritorious steam, mining, electrical and refrigerating machinery; excellent connections and experiences. L. J. Hollawaith, 412 Girard Building, Philadelphia.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

An electrical and mechanical engineer, soon to locate in a large industrial city, wishes to handle a few engineering appliances in connection with professional work; correspondence with manufacturers solicited. Address E. P., care AMERICAN MACHINIST.

Press work done at short notice; blanking and drawing our specialty; estimates cheerfully furnished; tools for all work made on premises if desired; copper, brass and nickel plating; correspondence solicited. Acme Ball-Bearing Caster Co., Chappaqua, N. Y.

Factory for Sale.—The land and building of the Branford Lock Works are offered for sale, comprising six acres of land and about 90,000 sq. ft. of floor area, together with boilers, engines, pumps, heating apparatus and electric light system; Branford is seven miles east of New Haven, Conn., on the N. Y., N. H. & H. R. R. For particulars address the owner, The Yale & Towne Mfg. Co., 9 Murray st., New York.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Draftsman, mechanical, seeking position. Box 630, AMERICAN MACHINIST.

Experienced mechanical draftsman wants position. Box 637, AMERICAN MACHINIST.

Machine shop foreman at liberty; first-class references; good executive ability. Box 642, AMERICAN MACHINIST.

First-class metal pattern maker (understands molding machine) wants position. Box 602, AMERICAN MACHINIST.

Mechanical draftsman, 1 year's experience; received technical education at night school. B. S., care AMERICAN MACHINIST.

Foreman for machine shop, with many years of experience, hustler and up-to-date man, is open for position. Box 635, AM. M.

Bookkeeper, 7 years' experience, wants position with opportunity to learn drawing and develop mechanical tastes. Box 631, AM. M.

Molding machine expert wants position; has 8 years of experience on brass, iron and wood patterns for molding machine. Box 603, AMERICAN MACHINIST.

Wanted—Position as manager or superintendent of engine or tool works; age 35; past 10 years in first-class positions. Box 622, AMERICAN MACHINIST.

Designing draftsman, 10 years' shop and office experience on steam engines, turbines and paper machinery, wants position. Box 636, AMERICAN MACHINIST.

Position as superintendent or foreman of gasoline automobiles, either experimental or manufacturing; experienced with best makes. Box 628, AMERICAN MACHINIST.

Tool designer wants position; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

Superintendent of agricultural machine and implement factory desires a change; 12 years' experience; good executive ability and a hustler. Address Box 617, AMER. MACH.

Foreman machinist, 10 years' experience, desires a position; good handler of help; can furnish best of references regarding character, ability, past experience, etc. Box 641, A. M.

Factory cost accountant open for engagement; competent to install and direct a modern cost-accounting system; 10 years' experience in manufacturing bookkeeping. Box 625, AMERICAN MACHINIST.

Machine shop foreman or superintendent; extensive experience, practical and reliable; 16 years' practice, 7 years as general foreman; A1 reference. Address "Mechanic," Box 634, AMERICAN MACHINIST.

Draftsman and designer, capable of engineering and superintending, large experience on automatic machinery and tools, age 31, graduate, references, wants to change. Box 600, AMERICAN MACHINIST.

A gentleman with years of experience as a works manager is desirous of securing a position with some pushing manufacturing company where ability and practicability are needed and will be appreciated. Address Box 633, AMERICAN MACHINIST.

An American, just returned from Europe, where he has been for the past 6 years, laying down plant and superintending the manufacture of a specialty, wishes position as superintendent with reliable concern. Box 632, AMERICAN MACHINIST.

A practical mechanical engineer would like to engage with reliable concern building or about to build mining, quarrying and prospecting machinery; wide experience in this line; can show various machines in successful operation; location not particular. Box 643, A. M.

A widely experienced superintendent and manager of machine works, expert in best shop practice and construction, of reliable executive ability and high-class references, seeks position with progressive and broad-minded concern. Address Y., 635 W. 61st st., Chicago.

Machinist and toolmaker, ready to hustle on tool die or medium sized work; working or sub-foremanship preferred, where experience in modern methods, some technical education and jig designing would count; now holds responsible job with good company, at 35 cents; age 27. Box 624, AMERICAN MACHINIST.

Mechanical engineer and mill architect open for engagement; salary or percentage; thoroughly posted in brick, steel and concrete construction, saw-tooth roofs, power plants, electric transmission and shop fixtures; up to date and very successful; plans, specifications and general supervision of all work; specialty large, complete factory buildings ready for occupancy. "Buildings," care AM. MACH.

Experienced man in machine shop, factory and drawing-room management, with last 3 years in charge of the engineering department of a large machine tool works, desires to make a change soon; is well up in modern machine shop practice, interchangeable parts,

manufacturing methods and reduction of cost by systematization, labor-saving devices and labor rewards; correspondence solicited. Address Box 629, AMERICAN MACHINIST.

Help Wanted.

Wanted—Good toolmakers. Keystone Electric Company, Erie, Pa.

Wanted—Experienced mechanical draftsman; state salary and experience. Address Box 626, AMERICAN MACHINIST.

First-class machine tool designer; a position to take charge is open to the right man. Address Box 606, AMERICAN MACHINIST.

Wanted—A first-class draftsman who is familiar with high-speed engine design; works, Trenton, N. J. Box 610, AMER. MACHINIST.

Wanted—Good mechanical draftsman; one familiar with automobile work preferred; only first-class man need apply. "Y.," AM. M.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—A good modern machine tool designer, accustomed to extra heavy work. Apply, stating where employed, to Box 607, AMERICAN MACHINIST.

Wanted—First-class toolmaker; one accustomed to fixtures and jig making for small interchangeable work. Address "Permanent," Box 638, AMERICAN MACHINIST.

Wanted—Electrical works, Middle West, experienced foreman commutator department; reply, stating experience and wages expected. Box 627, AMERICAN MACHINIST.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

General foreman on high-speed engine building; must be systematic and thoroughly up on modern shop practice; new shop and tools; permanent position with advancement to right man. B. M., care AMERICAN MACHINIST.

Wanted—Two draftsmen on tools and special machinery, by large company located in the country; steady work, 44 hours a week; wages $21; state age, experience and how soon available. Box 623, AMER. MACHINIST.

Wanted—Several first-class toolmakers and all-round machinists on small work; up-to-date shop and tools, located in Worcester County, Mass.; state age, experience and wages expected. Box 619, AMER. MACHINIST.

Wanted—Competent draftsman, with experience in designing Corliss, slide-valve and hoisting engines, air compressors and coal-mining machinery; state age, experience and salary expected. Box 618, AMER. MACH.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—Foundry foreman experienced in medium and heavy castings, green sand and loam work, by foundry employing about thirty molders; give age, married or single, references and salary expected. Address Box 640, AMERICAN MACHINIST.

Wanted—Highest-class patternmakers for modern machine tool shop in city of 25,000, located 100 miles from Chicago; highest wages paid and steady employment given. Address, giving references and experience, Box 639, AMERICAN MACHINIST.

Wanted—Assistant manager for plant manufacturing automatic engines and similar machines; limited number of men; must be a good manager of men and thoroughly up on handling work systematically and expeditiously. Address G. B., care AMER. MACHINIST.

Wanted—Thoroughly competent foreman on machine tool building, experienced in building pipe threading machinery, familiar with methods of producing duplicate parts on turret lathes; give age, experience, salary expected and references. Box 237, AMER. MACH.

Wanted—Two machine foremen, two bench and erecting foremen, one leading hand on tool and jig work; men wanted accustomed to modern shop methods; line of work, pumping machinery; permanent positions for competent men; state age, experience and wages expected. Geo. E. Dow Pumping Engine Co., San Francisco, Cal.

Machinist Wanted.—To keep pace with our rapid growth we need an additional number of experienced machinists; we want steady men of good habits, looking for permanent positions; school, home and health advantages of Madison are unsurpassed; write immediately for particulars; state age, experience, etc. Northern Electrical Mfg. Co., Madison, Wis.

Wanted by a large manufacturing concern in Seattle, Washington, a first-class foreman blacksmith; a young, progressive man preferred; must have wide knowledge of all classes of blacksmith work, light and heavy, and above all he must be a good handler of men, familiar with drawings and of fair education. Address, stating full qualifications, reference and monthly salary expected, P. O. Box 319, Seattle, Wasnington.

Wanted.—Machinists, toolmakers, draftsmen, do you want to increase your salary? They all say that Saunders' enlarged edition "Hand Book Practical Mechanics" exactly fills the bill for valuable shop kinks, rules, etc., figured out by simple arithmetic and drawings; also most complete reference tables in existence, many taken from note books of best mechanics in the country. Pocket size. Price, post paid, only $1, cloth; $1.25 leather. Agents wanted. Book sells itself. Big money. C. H. Saunders, 216 Purchase st., Boston, Mass.

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Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
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Carborundum
See Grinding.

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Farrel Fdry. & Mach. Co., Ansonia, Conn.
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Niles Tool Works Co., New York.
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Baush Mch. Tool Co., Springfield, Mass.
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McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
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Springfield Gas Eng. Co., Springfield, O.
Struthers, Wells & Co., Warren, Pa.
Weber Gas & Gasoline Eng. Co., Kansas City, Mo.

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Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
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Wyman & Gordon, Worcester, Mass.

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Wyman & Gordon, Worcester, Mass.

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Starrett Co., L. S., Athol, Mass.

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Niles Tool Works Co., New York.
Walcott & Son, Geo. D., Jackson, Mich.
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Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Chicago, Ill.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Hardinge Bros., Chicago, Ill.
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Horsburgh & Scott, Cleveland, O.
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N. Y. Gear Works, Brooklyn, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Turley, J. G., St. Louis, Mo.
Walcott & Son, Geo. D., Jackson, Mich.

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Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
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New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
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Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
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Grinders, Center
Browning Mfg. Co., Milwaukee, Wis.
Heald & Son, L. S., Barre, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Blenenstok & Co., E. A., St. Louis, Mo.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Modern Tool Co., Erie, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Blenenstok & Co., E. A., St. Louis, Mo.
Blount & Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Safety Emery Wheel Co., Springfield, Mass.
Vitrified Wheel Co., Westfield, Mass.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

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Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
Olmsted, L. H., Hasbrouck Heights, N. J.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams, White & Co., Moline, Ill.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

Handles, Machine Tool
Norwood Mach. & Mfg. Co., Cincinnati, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Enginering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Igniters, Gas Engine
Maxwell Engineering Co., Rome, N. Y.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.
Woodman Mfg. & Supply Co., S., Boston, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Rue Mfg. Co., Philadelphia, Pa.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Hill Tool Co., Anderson, Ind.
Mitts & Merrill, Saginaw, Mich.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Blount & Co., J. G., Everett, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fairbanks Mach. Tool Co., Springfield, Ohio.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Greaves, Klusman & Co., Cincinnati, Ohio.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply So., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.
Walcott & Son, Geo. D., Jackson, Mich.
Washburn Shops, Worcester, Mass.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Fenn-Sadler Mach. Co., Hartford, Conn.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Boring
Streit Mach. Co., A., Cincin., O.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Turner & Co., F. L., Orange, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rowbottom Mach. Co., Waterbury, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Syracuse Twist Drill Co., Syracuse, N. Y.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Stow Mfg. Co., Binghamton, N. Y.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.
Murdock Parlor Grate Co., Boston, Mass.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Lathe
New Britain Mach. Co., New Britain, Conn.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Cullen, Orlan Clyde, Washington, D. C.
Straley, Hasbrouck & Schloeder, New York.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Balkwill Pattern Works, Cleveland, O.
Gobeille Pattern Co., Cleveland, O.
Olmstead & Co., H. B., New York.
Topping, Jas. R., Hartford, Conn.

Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Pipe Cutting and Threading Machines
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers, Portable
Morton Mfg. Co., Muskegon Heights, Mich.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Planers
Amer. Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Presses, Hand
Elmes Engr. Co., Chas. F., Chicago, Ill.

Presses, Hydraulic
Bement, Miles & Co., New York.
Elmes Engr. Co., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Streit Mch. Co., A., Cincinnati, O.

Pulleys
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Elmes Engr. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.
Walcott & Son, Geo. D., Jackson, Mich.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Walcott & Son, Geo. D., Jackson, Mich.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Reamers
Chadwick & Co., G. B., Portsmouth, N. H.
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
American Roller Bearing Co., Boston, Mass.
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sand Blast Apparatus
Paxson Co., J. W., Philadel., Pa.

Sand Mixing Machines
Smith Fdry. Supply Co., J. D., Cleveland, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Nutter, Barnes & Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.
West Haven Mfg. Co., New Haven, Conn.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
Purdue University, Lafayette, Ind.
Worcester Polytechnic Institute, Worcester, Mass.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegheny, Pa.
Chicago House Wrecking Co., Chicago, Ill.
Dawson, John H., Chicago, Ill.
Dustin Co., Chas. E., New York.
Fairbanks Co., New York.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Gump & Co., A. W., Dayton, O.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Separators, Oil
Springfield Separator Co., Springfield, Vt.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
Amer. Tool Wks. Co., Cincin., O.
Bement, Miles & Co., New Haven.
Blount & Co., J. G., Everett, Mass.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Smith & Mills, Cincinnati, O.
Steptoe & Co., John, Cincinnati, O.
Walcott & Son, Geo. D., Jackson, Mich.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Springs
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros., Bristol, Conn.

Sprocket Chains
See Driving Chains.

Squares
Turner & Co., F. L., Orange, Mass.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
Herman Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriache & Bell, New York.
Westmoreland Steel Co., Pittsburgh, Pa.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Straightener, Screw
Towsley Mfg. Co., John T., Cincinnati, O.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Fulton Fdry. & Mach. Co., Brooklyn, N. Y.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hardinge Bros., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Washburn Shops, Worcester, Mass.

Trucks, Shop
Towsley Mfg. Co., John T., Cincinnati, O.

Tubing, Steel
Shelby Steel Tube Co., Pittsburgh, Pa.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Unions, Brass
Nolte Brass Co., Springfield, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Hollands Mfg. Co., Erie, Pa.
Hopkinson Mach. Works, Springfield, Mass.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Bignall & Keeler Mfg. Co., Edwardsville, Pa.
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Emmert Mfg. Co., Waynesboro, Pa.
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automobile Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

A Cam Cutting Attachment for the Milling Machine.

The accompanying half-tones and line engraving illustrate a milling machine attachment made by the Brown & Sharpe Manufacturing Company, for cutting face and peripheral cams. As this attachment is provided with mechanism for rotating the blank and for feeding it to the cutter the milling machine table is clamped fast—after the job is set up—and remains stationary during the cutting of the cam.

Fig. 1 shows the attachment arranged for milling a peripheral cam. On the base *A*, which is bolted to the table of the machine, is fitted a slide or table *B* arranged to travel longitudinally and carrying a head and foot stock, the blank to be cut, and the apparatus for rotating the blank and for moving the slide.

The spindle in the head is driven by means of the worm wheel *C* and worm at the end of the head, the worm shaft being turned by the hand wheel *D* in front. The handle for this wheel can be drawn out to give sufficient leverage for quite heavy work. The worm wheel is provided with two T-slots at right angles to each other and carries a former *E*. This former, which is of course shaped to suit the cam to be cut, is made of flat steel, or can be of cast iron where only a few cams are required. Fastened to the end of the slide is a vertical guide *F* in which slides a rack *G*, this rack having at its upper end a hardened steel roll that comes in contact with the working surface of the former *E*. Referring to Fig. 2, it will be seen that the vertical rack *G* meshes with a pinion *H* (mounted on a stud in the slide *B*) and that this pinion also meshes with a horizontal rack *I* fastened to the base *A*.

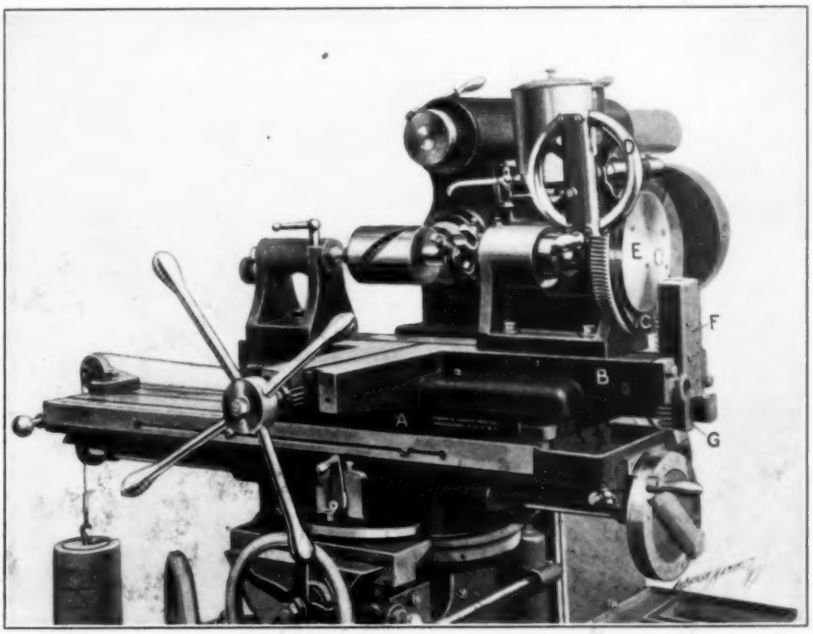


FIG. 1. CAM CUTTING ATTACHMENT.

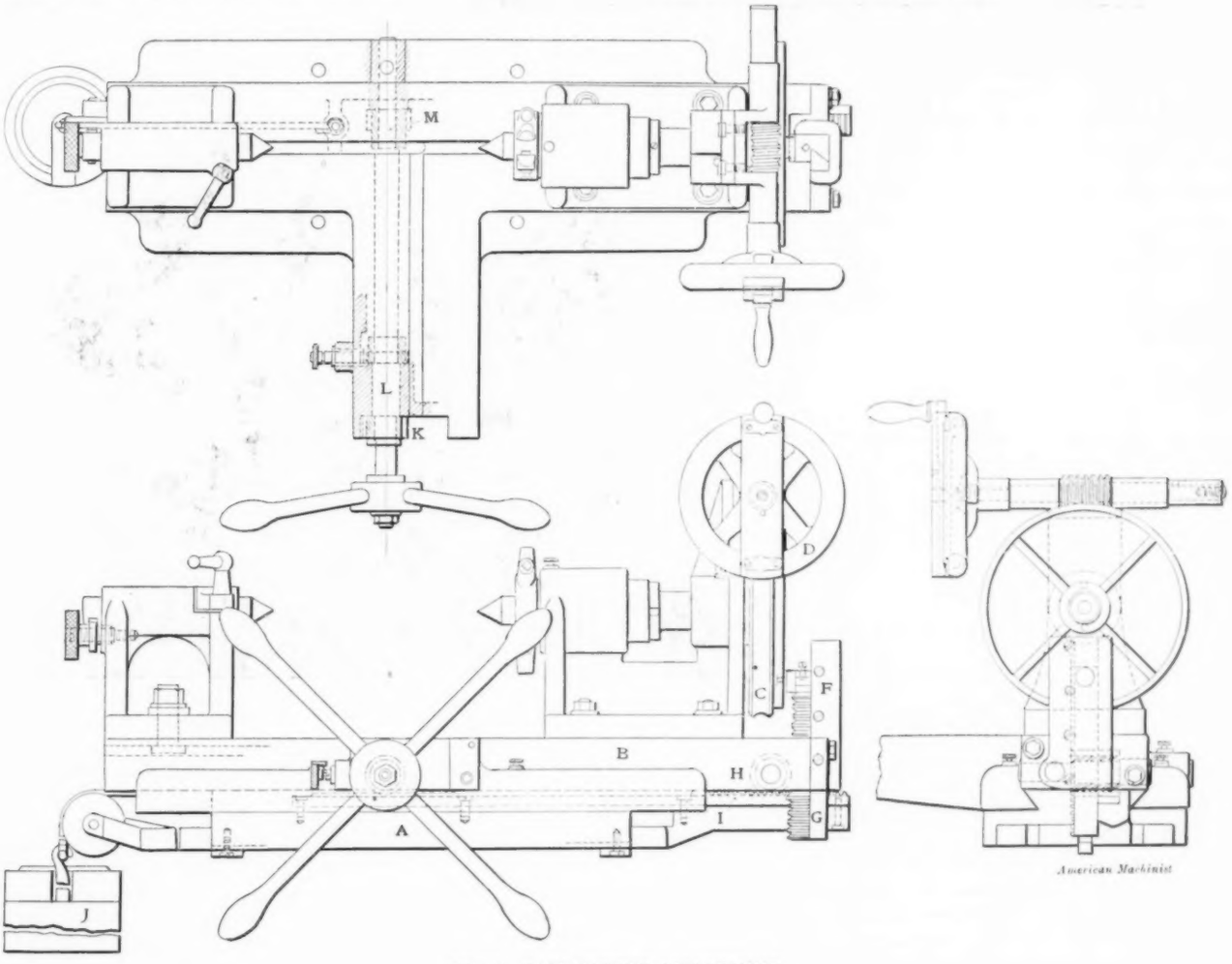


FIG. 2. CAM CUTTING ATTACHMENT.

When the rack *G* is forced downward the slide *B* is moved to the right, and when the pressure on the rack is removed the slide is drawn to the left by the weight *J* and the rack is run up. Thus the roller is always held against the former *E*, Fig. 1, and when the work is rotated by means of the hand wheel, the former, turning with the worm wheel gives the slide the necessary longitudinal movement.

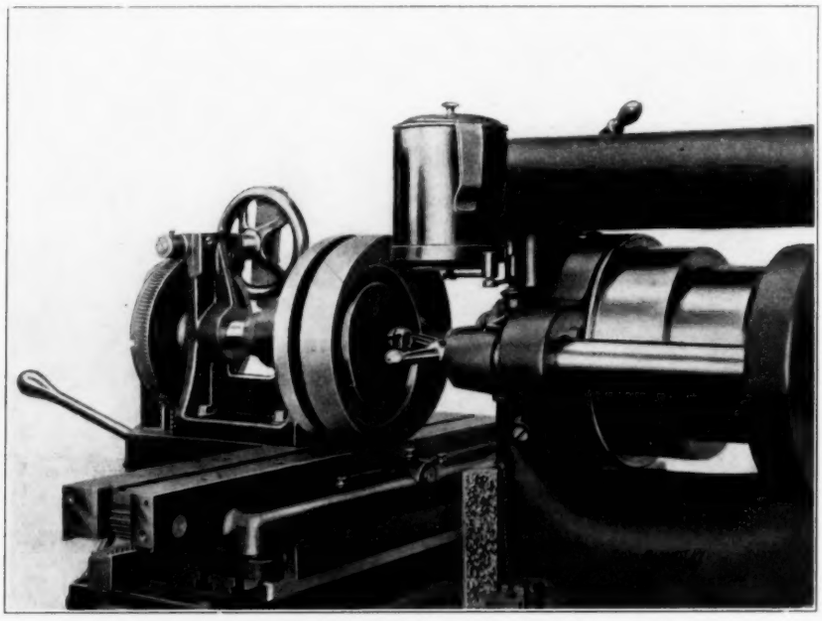


FIG. 3. CUTTING A FACE CAM.

When cutting a face cam, the head and the vertical rack *G* with the guide *F* are located—as shown in Figs. 3 and 4—with the head spindle parallel with the spindle of the milling machine. The rack *G* in this position meshes with the pinion *K*, Fig. 2, this pinion being fast on a shaft *L*, which carries on its inner end a pinion *M* meshing with the horizontal rack in the base *A*. The slide is thus operated in practically the same manner as when the head is located at the end.

When the former on the worm wheel is made with an abrupt rise the rack roll may be kept in contact with it by means of the pilot wheel fastened on the pinion shaft.

The St. Louis Exposition.

Our report of the Boston meeting of the American Society of Mechanical Engineers referred to an address by Lieut. Carden explaining some of the features of the Louisiana Purchase Exposition or World's Fair to be held at St. Louis. We were unable within the limits of our report to give Lieut. Carden's address in full, and it does not now seem necessary to do so, but it is proper to say that he called attention to the different relation borne by the United States Government to this exposition from that which it has borne to any previous exposition. In the present case the government has appropriated $5,000,000 in addition to the cost of its own exhibit, which amount was made available only after it was shown that $10,000,000 had been raised to be expended by the Exposition Company; and under the arrangement made the government will itself retain a voice in the management of the exposition. That is to say, no important step can be taken without the consent of the representatives of the government and the President of the United States is empowered to appoint a non-partisan commission of nine members, two members of this commission to act in conjunction with a like number appointed by the Exposition Company and these to constitute a board of arbitration on all matters of difference which may arise; in case they do not agree a fifth member may be selected by the Secretary of the Treasury. A monthly report is to be made to the President showing receipts and disbursements and giving a general summary of the financial condition of the Exposition, and in the matter of awards the rules are to be endorsed by the Government Commission and the awards before being issued must be confirmed by that commission. This will give the awards, in a certain sense, a government endorsement, which we suppose will be highly valued by many prize winners.

Regarding the scale on which the exposition is laid out, Lieut. Carden gave some interesting facts, saying that the Exposition ground covers about 1,200 acres, with the prospect of further enlargement. It is about two miles in extent north and south and about the same east and west. There will be a cascade coming down from "Art Hill" which will be 110 feet high, 200 feet wide and ¼ mile long. "Bunker Hill Monument," Lieut. Carden said, "if duplicated and stood on top of itself could be trundled through the 'Varied Industries' building without touching anything, and the exhibit floor space in the machinery building alone will be about double the total space devoted to all kinds and descriptions of exhibits at Buffalo."

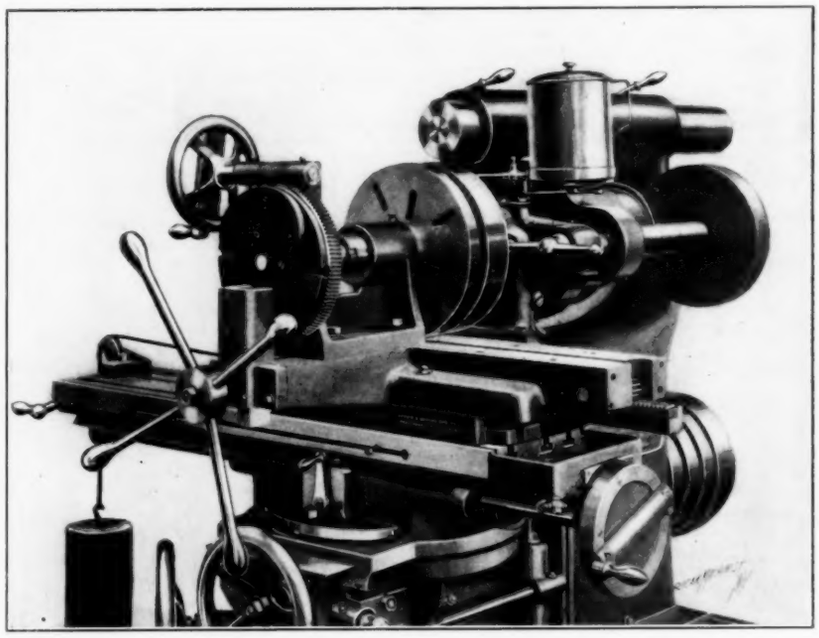


FIG. 4. CUTTING A FACE CAM.

A Diagram for the Combination of Direct and Shearing Stresses.

BY E. R. DOUGLAS.

There are well-known rules for finding the stresses in bodies loaded in certain simple ways—as for the longitudinal tension or compression in the extreme fibers of a beam, or for the shearing stress on the circumferential fibers of a shaft. But

it is sometimes necessary to consider the strength of pieces so loaded that the stress at a given point is neither a longitudinal tension or compression nor a transverse shear alone, but is a combination of the two in which neither element can safely be neglected.

Such cases are those of shafts transmitting power and at the same time carrying heavy weights or acted on by overhung cranks and the like. The actual maximum stress at any point will be greater than that due to either the torsion or the bending alone, and will be exerted in a direction different from either. While formulas exist for determining this magnitude and direction, it may be more convenient to make use of the accompanying diagram.

Suppose the stresses to be combined are a tension T acting perpendicularly to the plane of a shearing stress S, these values expressing intensities, such as pounds to the square inch. For convenience the left-hand half of the diagram is plotted for $\frac{S}{T}$, to be used when S is less than T, and the righthand half is plotted for $\frac{T}{S}$, to be used when S is greater than T. Then, P being the maximum resultant tensile stress and Q being the maximum resultant compressive stress, at right angles to P, the values of the ratios $\frac{P}{T}$ and $\frac{Q}{T}$ or $\frac{P}{S}$ and $\frac{Q}{S}$, and of the tangent of angle x between P and T may be read at once in terms of $\frac{S}{T}$ or $\frac{T}{S}$.

Had the original stress T been a compression instead of a tension, P would have been a compression and Q a tension, x still being the angle between P and T.

As an example of the use of this diagram, suppose that in some given case, as that of the shaft mentioned above, there is found to exist at a certain point a tensile stress of 8,000 pounds per square inch and a shearing stress of 3,600 pounds per square inch in a plane perpendicular to the tension. The ratio $\frac{S}{T}$ is $\frac{3600}{8000}$, or 0.45. Consulting the diagram we find $\frac{P}{T} = 1.175$. $\frac{Q}{T} = 0.175$, and tan. $x = 0.38$. Then the maximum resultant tension $P = 1.175 \times 8{,}000 = 9{,}400$ pounds per square inch, and its direction makes an angle whose tangent is 0.38, or 20° 50′ with the original tension, while there also exists a compression Q, normal to P, of value $0.175 \times 8{,}000 = 1{,}400$ pounds per square inch.

The material must safely stand a stress of 9,400 pounds per square inch in the direction found.

Had the original tension been, for instance, 3,000 pounds per square inch and the shearing stress 7,500 pounds per square inch, we would have taken $\frac{T}{S} = \frac{3000}{7500} = 0.4$, instead of $\frac{S}{T}$ as in the former case. Corresponding to $\frac{T}{S} = 0.4$ we find, in the right-hand side of the diagram, $\frac{P}{S} = 1.22$, $\frac{Q}{S} = \text{tan. } x = 0.82$.

Whence $P = 1.22 \times 7{,}500 = 9{,}150$ pounds per square inch maximum tension, making an angle of 39° 20′ with the original tension. $Q = 7{,}500 \times 0.82 = 6{,}150$ pounds per square inch compression at right angles to P. In this case the resultant tension is more than three times the original one.

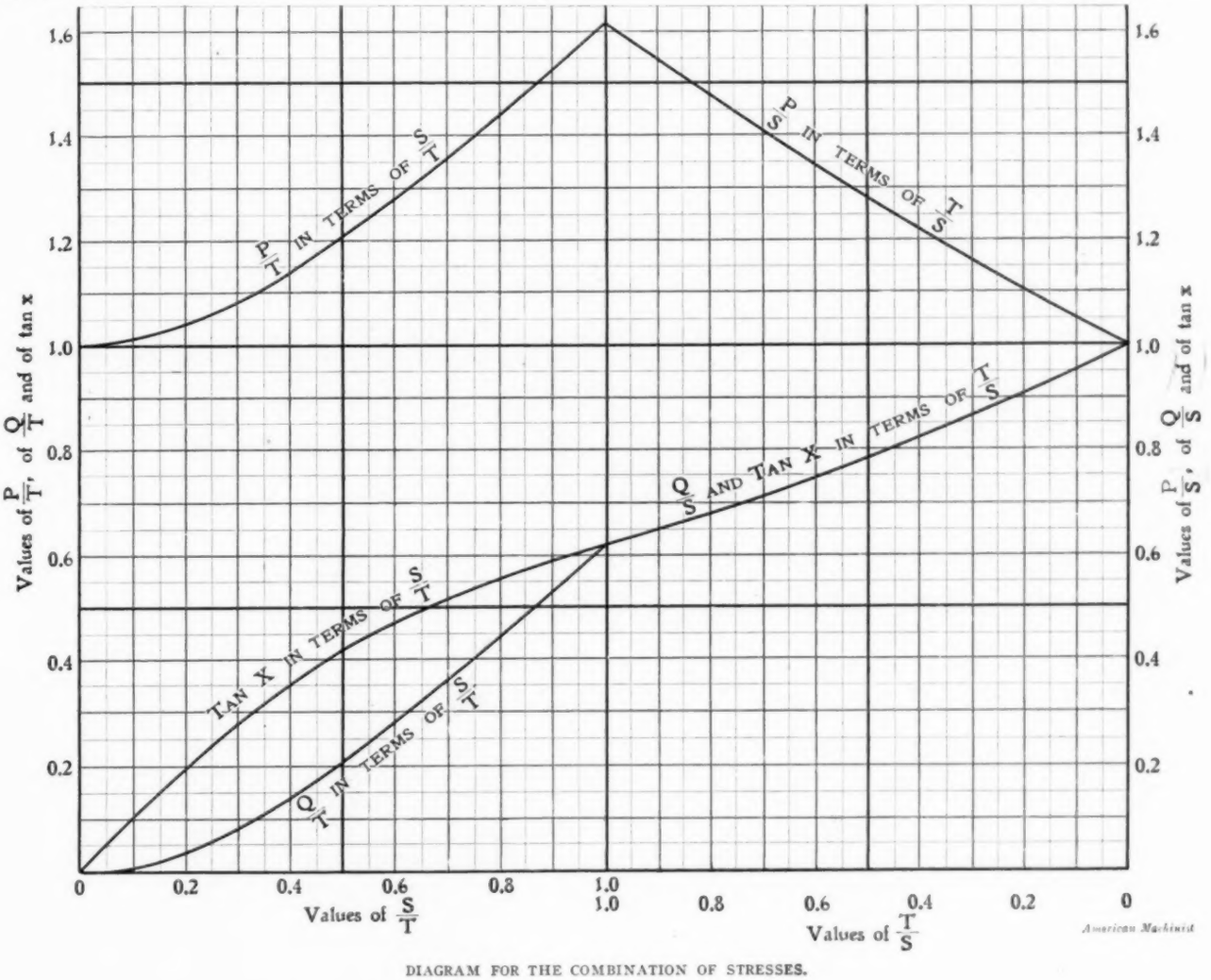


DIAGRAM FOR THE COMBINATION OF STRESSES.

A Combination Blanking Die.

BY WILLIAM DORAN.

The punch and die shown in Figs. 2 and 3 were made for producing at one operation blanks of 3-16 inch cold-rolled sheet steel of the shape shown in Fig. 1. The making of this punch and die was a milling machine job. First, a perfect templet of sheet steel was made. The die *A*, Fig. 2, a forging of machine steel with the top or die portion of tool steel, was then, after squaring the base, milled out on the inside, tapering inward about 1 degree, to the exact size and shape of the blank and draw-filed to a nice, smooth finish all around. After the other necessary work was accomplished and the cutting face sheared so that the blank would be first cut at both ends and the holes let in for the six stripper pins *G* and the stop-pin, the die was hardened, ground and tempered to a light straw. The base, being of mild steel, remained soft.

The internal punch *B*, of tool steel, was then milled and finished to the shape shown, the same as the inside of the templet, and the outside finished perfectly straight and smooth. This punch *B* was then located central within the die *A* by means of the templet, placing the latter within the die and the punch *B* within it. The holes for the screws *C C* and the dowel pins *O O* were then let in and the punch *B* located fast and true within the die without the possibility of shifting. Within the space between *B* and *A* six 9-32 inch holes were drilled through the base for the stripper and spring pad pins *F*, spacing them as shown in the plan. A hole was also let into the base for the spring stud *H* with a spring *I*, washer *J* and adjusting nuts *K*. The eight pins *G* are stripper pins for stripping the stock from the punch. The internal punch *B* was left soft. The blank stripping pad *E* is of flat machine steel worked out and finished to rest freely within the space between the punch *B* and the die *A*, as shown.

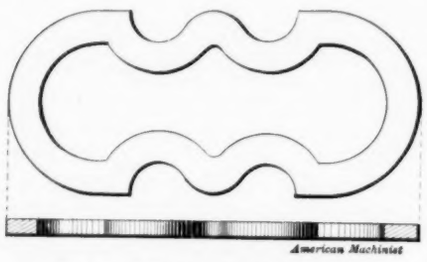


FIG. 1. THE BLANK TO BE MADE.

In making the punch *L* which also was a forging of mild steel with a tool-steel face, it was first turned and machined to finish the stem and then milled around the outside and inside to the shape of the templet, this being accomplished with ease by soldering the templet to the face of the punch and using the vertical attachment on the Cincinnati universal, and leaving about .007 inch of surplus stock all around. The edges both inside and outside were then nicely beveled, after which the punch was sheared into the die *A* by fastening both punch and die in the press in which it was to be used when finished, thus making sure of a perfect match of all the cutting edges.

The holes for the springs *N N* were then let into the punch and a hole was drilled and reamed through the stem for the stud *M*, which was let in into the knockout pad *D*. After the inside of the punch *L* was finished to the size of the internal punch *B* it was carefully hardened and drawn, after which the face was ground perfectly straight, so as to produce flat blanks, and all tight spots were lapped until it fitted nicely with the die all around. All the various parts were then assembled as shown and the punch and die were set up in the press. The strip of stock—well slushed—was then fed in under the stripper pins *G* and as the punch descended it blanked the outside of the work into the die *A* and the internal punch *B* punched the inside up into the male punch *L*. As the punch ascended, the spring pad *D* within the punch *L*, by the action of the two springs *N N*, expelled the waste, while the pad *E E* within the die *A*, in conjunction with the pins *F*, the pad *Q* and the spring *I*, stripped the finished blank from the die *A*, and a perfectly flat blank of the shape and size shown in Fig. 1 was the result.

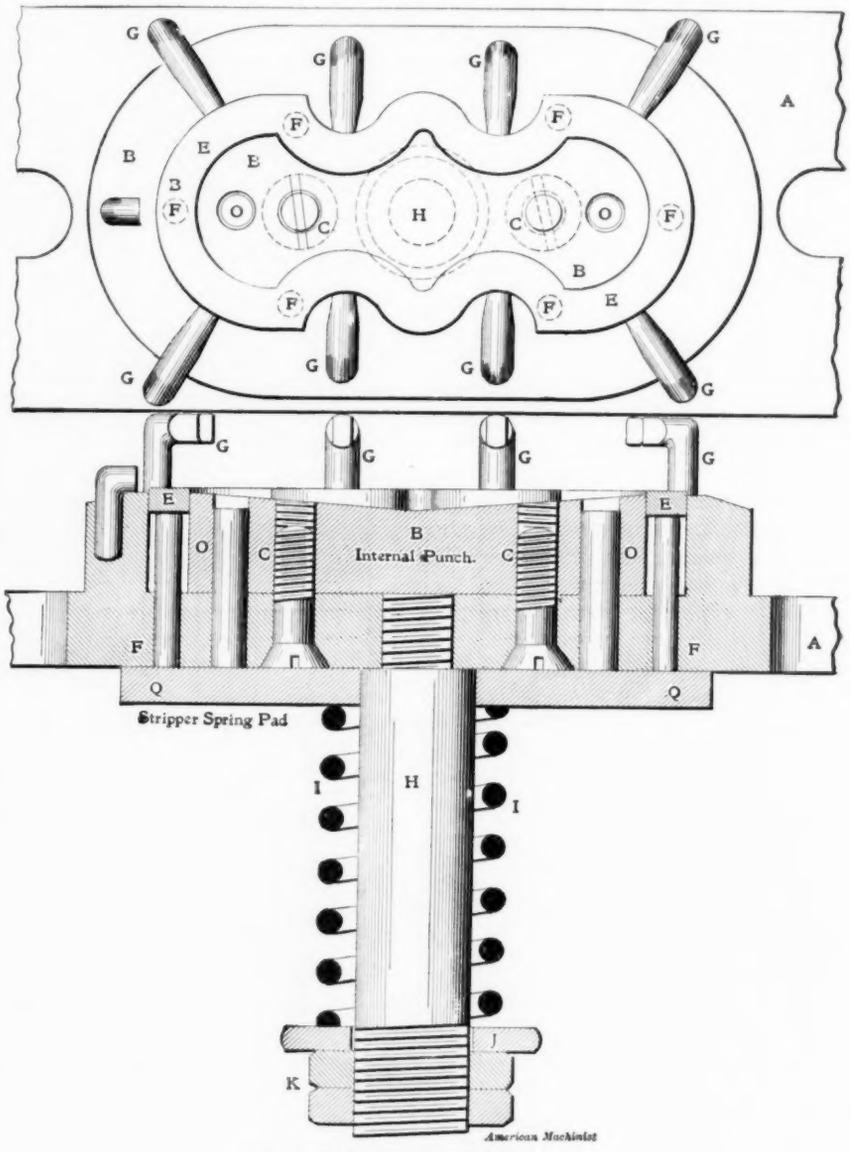


FIG. 2. COMBINATION BLANKING DIE.

Wrong Impressions Given by Mechanical Schools.

BY C. H. NORTON.

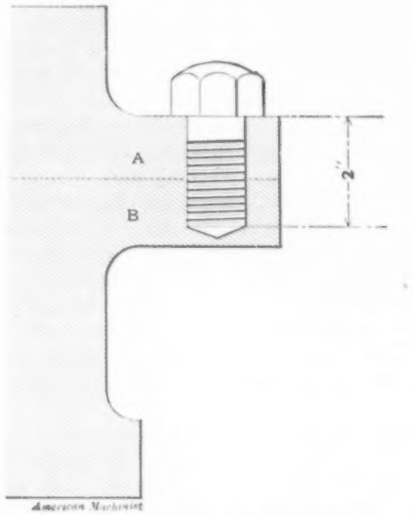
Recently a student of one of the correspondence schools asked the writer some questions as to the possibility of his obtaining a "paying position" through his course in mechanical drawing. He displayed some very handsome specimens of pen and ink picture copying to prove his fitness for the position of mechanical draftsman. It was evident that he had gained the impression from his instructors that when he had made these copies and they had passed a certain standard of inspection he would be fitted to take a "pay-

ing position." When I saw the corrections made by the instructor in pencil on those really beautiful pictures, I could but feel sorry for the young man, as not one feature of this inspection by the school had the least bearing on his success in that "paying position." The corrections pertained to infinitesimal points of shading and smoothness of line, and in this case were unwarranted, in view of the beautifully made copy. It was evident from the student's talk that he had not gained a single point that the commercial mechanical manager would consider important—aside, of course, from the pure mathematical knowledge obtained. When he secures that "position" he will find that, instead of being criticised because his shading is not perfect, he will be told that he must not shade the lines at all; that he must not spend time foolishly fussing over the quality of any of the lines, but that he must reason out the detail and put such figures on the drawing that the machine will all assemble and work if made to the figures. "Figures! Figures—not lines or measurement of lines. If your figures are right we do not care a fig for your lines." This is what he will hear from the practical engineer.

One of the pictures this student had copied, showed two castings united as in the sketch, the cap screw being shown the same length as the hole, reaching to the very bottom of the drill size; and what is worse, the figure for both screw and depth of drilling was one and the same figure. More!—this hole was stopped about 1-32 inch from through.

When this student gets that "position" he will draw a lot of screws and holes that way, the shop men will make them as he draws them, and the engineer or shop superintendent will find a number of dollars gone to the loss column because of the time lost correcting the error. Then when he explains to the student that it is impracticable to tap a hole so that a screw will go literally to the bottom, he will inform the engineer that "taps" are made, called "bottoming taps," to do this. When the engineer explains that it is best not to try to use the screw within several threads of the bottom, the student will say no more, but will disbelieve the statement, only to make the same trouble the next time he has a similar case in hand. After the expense of this fallacy has been well fixed, the engineer will discover that the hole should have been drilled clear through anyway, and when he asks the student why he did not draw it so, he will be informed, with all seriousness, that it is a neater job if not drilled through.

Another copy was of a drawing of a bench vise. It was of the swivel variety with a small taper-pin to hold the jaw in the parallel position. This taper-pin was shown in detail and marked "wrought iron" as well as the screw bar and screw. When this student gets that "position" he will make some drawings and mark details "wrought iron."



A STUDENT'S IDEA OF A TAPPED HOLE.

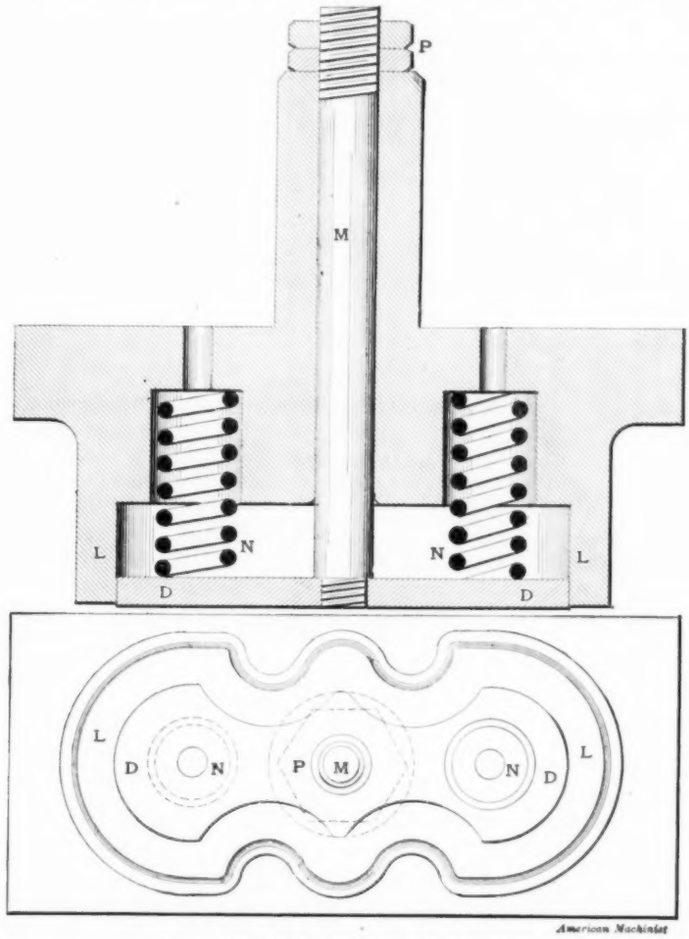


FIG. 3. COMBINATION BLANKING PUNCH.

This recalls an experience of the writer that was very costly. A workman gave as an excuse for delay on certain work that he was "waiting for stock." Inquiring at the stockroom why they did not have that size stock brought the reply that they did not have a bit of wrought iron in stock and had been obliged to send a special order for it. Further investigation showed that a student draftsman had used the knowledge he had acquired at school and marked his drawings "wrought iron" in every case where it should have been machine steel, but the discovery was made too late to countermand the order for the stock.

There is no excuse for such nonsense as this, when all mechanical establishments in this land having the elements of commercial life use practically no wrought iron for machine details, and have not for a number of years, and also *never* manufacture machinery with holes drilled like the sketch, as it is physically impossible to make a screw go literally to the bottom of a tapped hole, and therefore is never done.

When it is so easy for teachers to learn these simple things it is nothing short of quackery to go on year after year sending out plates for students to copy that have on them these gross errors.

Is is of course impossible for schools to teach the commercial side of mechanics, but it is not only possible, but perfectly feasible to teach the student that it will not be his lines that will be criticised, that no up-to-date shop allows the least pretense of shade lines, and that wrought iron is used so rarely that it amounts to practically never. There is probably no modern shop where teachers are not welcome to

learn these simple commercial facts about what is wanted of the draftsman by the engineer or manager who must run his shop to make money. There are enough simple facts that could reach the student through the schools to make the difference between a helpful draftsman and one who has to be laboriously carried by the engineer until he wears off these fallacies he learned at school. I have never heard an engineer or manager criticise the mathematical training of students, the criticism being always similar to the one here made. It is a very simple matter for the schools to learn what practical men require of a drawing, but when these things are written or told by the practical man, the schools, if successful, must give the student the practical man's exact words and not attempt to give them *school color*. In other words, the teacher has every opportunity to learn from the shopman what the student must learn before he can be of value in that "position." And why should not the teacher so learn if he presumes to teach boys to take positions with commercial men?

[It seems impossible to make a certain and large class of "teachers" understand that making drawings involves anything more than nicety of execution. Unlike Mr. Norton, we do not believe that such a teacher can materially improve his work by such points as he can pick up by visiting shops. The points mentioned could be so learned, but "there are others." To teach commercial drawing one must have been a commercial draftsman, and this involves a knowledge of shop methods and of the shop view of things which is not to be acquired by mere visits of inspection. With Mr. Norton we can see no reason why the schools should not turn out helpful draftsmen, but we know perfectly well that it is not often done.—Ed.]

The Determination of the Temperatures in a Gasoline Engine Cylinder.

BY E. C. OLIVER.

Before any computations regarding the temperatures of the gases within the cylinder of a gas or gasoline engine can be made, it is necessary to determine something of the behavior of these gases.

What actually does take place regarding the heat interchange during the four strokes of the Otto cycle is not known definitely, and until it is, any analysis tending to obtain temperatures at various points of the cycle must be based on some assumption, and the results will only be accurate in proportion as that assumption is accurate.

If an assumption is to be made, it will help matters to learn what quantity may be obtained most nearly accurate and which will have the least effect on the final results.

If the gases are followed through a part of the cycle, that after release, the action is found to be somewhat as follows: Before the exhaust valve opens the burned gases have considerable pressure and temperature. On the opening of the exhaust valve there is a rapid expansion down to atmospheric pressure, at which time much the larger part of the gas is expelled. A smaller portion remains in the cylinder to be expelled during the return stroke of the piston and a still smaller portion is not expelled at all, but fills the clearance space and is mixed with the fresh charge during the suction stroke.

If it were possible to obtain the temperature of this small portion of gas, even approximately, we would have sufficient data to determine the temperatures throughout the cycle with a fair degree of accuracy. The term "approximately" does not carry so great weight in regard to this term as it might at any other point in the cycle, since the weight of this gas is necessarily quite small and the temperature very great; further, the error, should there be one, would be converging rather than diverging in its effect on the results, since the weight of the gas is computed by means of the temperature, and should the temperature be too great, the weight would be slightly smaller and conversely.

It is evident that there can be no very important interchange of heat during the exhaust or suction stroke, as the cylinder walls are cooling continuously, due to the action of the water jacket, and at the same time the gases contained within the cylinder are being cooled from outside causes. First, at exhaust the temperature is lowered with the pressure and during suction stroke by the cool incoming charge.

If, then, the temperature of this clearance gas is considered the same as the temperature of the remainder of the exhaust gas at atmospheric pressure, we may proceed as follows, making use of the data given in a previous article describing the test.

Total weight of exhaust gas expelled—45.1 pounds.

Temperature of exhaust gas expelled—102 degrees Fahr.

Total heat abstracted by cooling exhaust gas—14,134 B. T. U.'s.

Specific heat at constant pressure—.2573.

Water of combustion, liquified—3.39 pounds.

The last item was determined from the known weight of hydrogen contained in the gasoline.

If now the process of cooling the exhaust gas is reversed we must necessarily arrive at the temperature after expansion to atmospheric pressure.

Before heating the gas the water of combustion must be heated to 212 degrees and evaporated. This process will require 111 B. T. U.'s per pound to heat, 965.7 B. T. U.'s per pound to evaporate, and the B. T. U.'s available for heating the body of the gas will be

$$14{,}134 - 3.39\,(965.7 + 111) = 10{,}484$$

As the total weight of gas is 45.1 pounds, this will allow $\frac{10484}{45.1} = 232.5$ B. T. U.'s per pound of gas.

With a specific heat of .2573 this amount of heat will produce a rise of temperature of $\frac{232.5}{.2573} = 904$ degrees.

This added to the initial temperature, 102 degrees Fahr., equals 1006 degrees Fahr. as the temperature of the exhaust gas at atmospheric pressure, which in absolute degrees is 1,467, and this we will take as the temperature of the gas remaining in the clearance space of the cylinder.

To find the weight of the burned gas in the clearance space we will use the formula previously referred to: $PV = mRT$, or $m = \frac{PV}{RT}$.

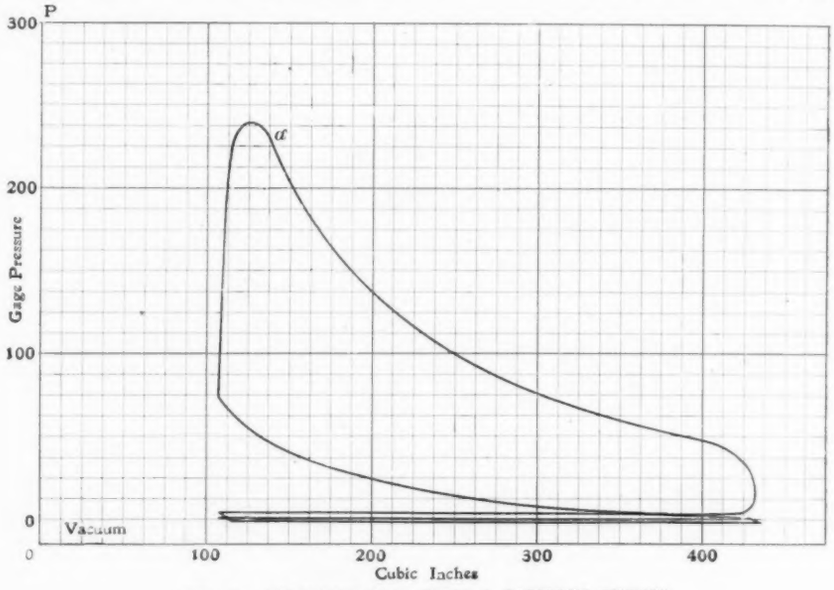


FIG. I. INDICATOR CARD FROM A GASOLINE ENGINE.

For this gas
$P = 1.8 + 14.7 = 16.5 \times 144$,
$V = 107$ cubic inches or .062 cubic feet,
$R = 55$,
$T = 1{,}467$ degrees.

Then $m = \frac{16.5 \times 144 \times .062}{55 \times 1467} = .00182$.

The total weight of air during the test was 42.67 pounds. The total weight of gasoline during test was 2.42 pounds. The total number of explosions was 3,332.

$\frac{42.67}{3332} = .012806$ = weight of air per explosion.

$\frac{2.42}{3332} = .000729$ = weight of gasoline per explosion.

The temperature of air and gasoline was 70 degrees.

At the end of the suction stroke the mixture is composed of .012806 pound air at 531 degrees absolute, .000729 pound gasoline at 531 degrees absolute, .00182 pound burned gas at 1,467 degrees absolute; and if T be the resulting temperature, then

$(.00182)\ (1467. - T)\ .2573 = .000729\ (T - 531)\ .404 + .012806\ (T - 531)\ 2375$,

from which

$$.1404 = \frac{T - 531}{1467 - T}$$

and $T = 646$ degrees absolute, or 185 degrees Fahr. Therefore the temperature at the beginning of the compression stroke is 185 degrees Fahr.

To find the temperature at the end of the compression stroke we use the formula by which we find the weight of gas in the clearance ($P V = m R T$), but we must find a new value for R, since the gas has a new composition. This is done as before, by adding together the proportional parts of the specific heats, as in the case of the burned gas:

	Pounds.	% weight.	Cp	Cv	% Cp	% Cv
Burned gas,	.00182	11.8	.3236	.2338	.0382	.0276
Gasoline,	.000729	4.7	.404	.359	.019	.0168
Air, .	.012806	83.5	.2375	.1684	.1981	.1405
Total,	.015355				.2553	.1849

$C p = .2553$.
$C v = .1849$.
$R = (.2553 - .1849)\ 778 = 54.77$.

Then the temperature at the end of the compression stroke, with $P = 89.2 \times 144$ and $V = 107$ cubic inches or .062 cubic foot, will be:

$$\frac{89.2 \times 144 \times .062}{.015355 \times 54.77} = 946° \text{ absolute.}$$

After explosion the gas changes its properties and we use for our temperature equations the constant R for the burned gas, which, from the analysis, we have already found to be 55.

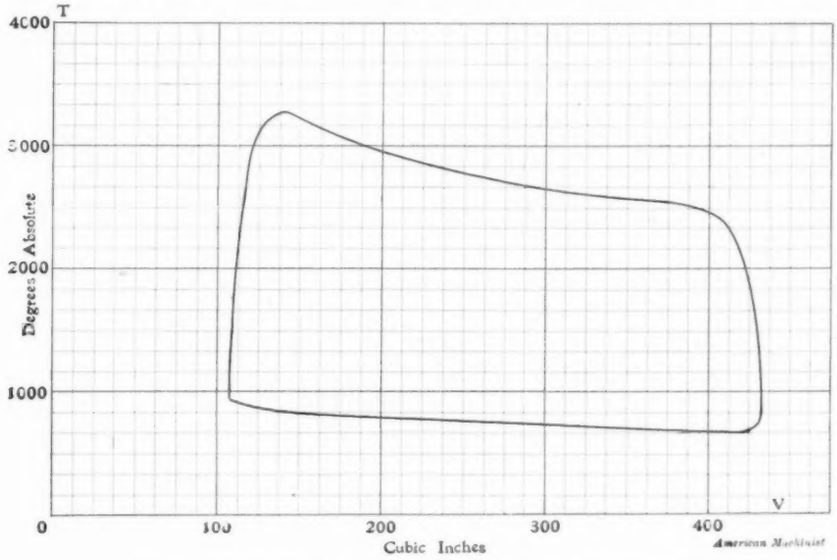


FIG. 2. TEMPERATURE VOLUME DIAGRAM FOR A GASOLINE ENGINE.

The highest temperature will be reached at that point in the cycle where expansion begins (at a, Fig. 1) for this point $P = 239.7 \times 144$, $V = \frac{139}{1728}$ $R = 55$ $m = .015355$

$$T = \frac{239.7 \times 144 \times 139}{.015355 \times 55 \times 1728} = 3282° \text{ abs.}$$

and the temperature at release is

$$\frac{622 \times 144 \times 400}{.015355 \times 55 \times 1728} = 2460° \text{ abs.}$$

In like manner the temperatures at other points throughout the cycle have been calculated and a temperature volume curve drawn, Fig. 2, which shows the kind of a diagram which we might expect had we a recording thermometer which we could attach to the cylinder of a gas engine in the same way that we attach a pressure volume indicator.

Since the above was finished the writer has had the pleasure of reading the two papers by Mr. R. H. Fernald on like subjects, presented at the Boston meeting of the American Society of Mechanical Engineers. It may be interesting to know that the engine used by Mr. Fernald was identical in make with that used by the writer, the only differences being in the size of the cylinder, 5¾ and 6 inches, and in the clearance space, .062 and .055 cubic foot.

Foundry Conditions.*

BY HUGH M'PHEE.

Taking the average foundry of the present day, generally speaking, we find conditions existing that are not creditable to either employer or the foreman in charge. A lack of interest, it seems to me, is the cause of this. The molder and apprentice, in my estimation, should not be held responsible for this, for we find that the improvements in all the other departments of great manufacturing concerns result in benefit to both employer and employee. Unfortunately, these results are not met with in the foundry. Not that less work should be done, but ways and means should be provided to increase the efficiency of a shop. This, I think, can only be done by a combined effort on the part of the employer and his foreman to make the conditions such that the employee can have a place to work in that will give him heart and interest to do better than he ever did before.

Take the molder who commences at 7 A. M. As he strips for work, he hangs his clothes on a spike driven into the wall as near his floor as may be convenient. Many times these clothes drop to the floor, and no one bothers with them. Now he finds his flasks shaken out during the night, but must tear the castings out of the sand, wet this down, get his shovel and temper his sand pile so that he can commence to mold.

By the time he is ready to mold a day's work he is played out, but by dint of practice and the necessity of doing so he labors on with only one outlook before his mind—quitting time.

Now we know that things are usually severe enough to bear even with the best of conditions, for we all have had more or less of just this experience. Believing that a remedy is absolutely necessary, let us look at the conditions prevailing in the machine shop and the pattern shop. A machinist has a specified machine to operate, with helpers conveying the castings to be finished to him, keeping him supplied with material to perform his share of the production. Producing finished work gives him an interest in it which is of benefit to his employer.

The same holds true in the pattern shop. The patternmaker has a bench to work at. His lumber is brought to the shop, laid down convenient to the saw and planer. He can get his material without any special exertion; in fact, everything is placed

*At the Boston meeting of the American Foundrymen's Association.

for him in such a way that he has only to perform the work that his trade demands.

Now, why cannot we have some such conditions existing in the foundry. This is in itself a less desirable place to work in on account of the dust and dirt. Have a place for each man to hang up his clothes in, so that he can wear good ones. Have his floor in the same condition as the machinist has his—ready to begin work on. Let helpers prepare his sand pile so that he can commence molding, and not act in the capacity of a laborer the first two hours of the day. Let his castings be shaken out for him, his flasks be fixed up. He can then put in eight hours molding instead of six, and get out superior work and much more of it.

May this effort to present the subject in a somewhat different light result in awakening the interest of my foundry colleagues, and let some action be taken toward the improvement of the conditions

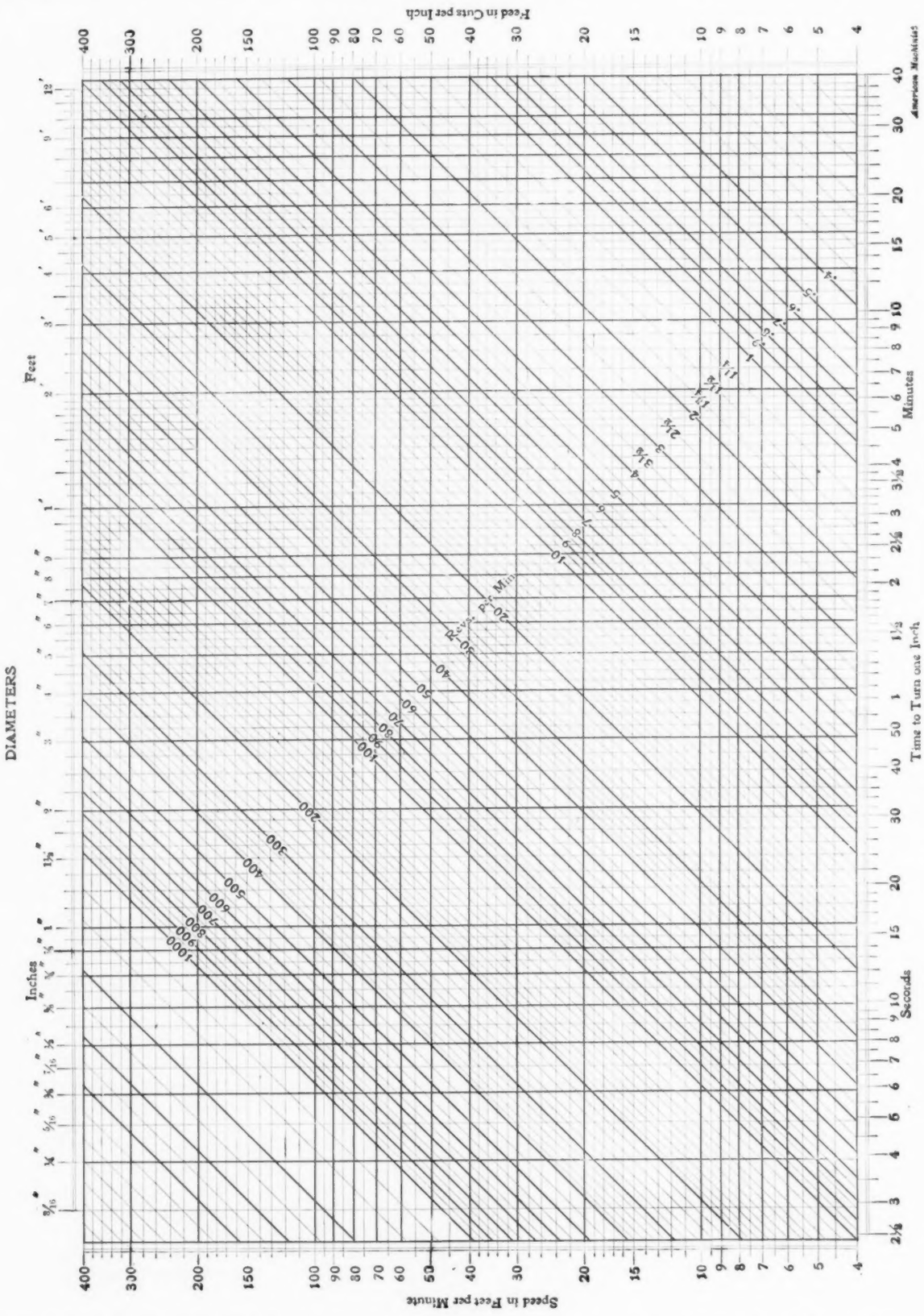


FIG. 1. DIAGRAM FOR ESTIMATING TIME REQUIRED FOR LATHE WORK.

surrounding the molder. Then the trade will receive greater appreciation everywhere, and stand second to none.

Diagram for Estimating Time Required for Turning Work in Lathes, etc.

BY ARNOLD THOMPSON.

The accompanying chart, the writer believes, will be of considerable use to managers, draftsmen, cost clerks, foremen and others who have to estimate time taken to turn work in lathes, automatic screw machines, turret and capstan lathes, etc.

The calculations necessary to arrive at the time by ordinary means—whether from tables, by arithmetic, or with the slide-rule—are usually a rather tedious job, especially when a great number have to be taken out. Besides, the result is only approximate, as the actual time is dependent upon so many functions over which we have no control, as, for example, the varying speed of main shaft, slip of belts, etc.

The chart shown in Fig. 1 will give results with no greater percentage of inaccuracy than the slide-rule, with less trouble and in a shorter time, while the range covered will, it is believed, meet most ordinary jobs, giving diameters from 3-16 inch to 12 feet, cutting speeds from 4 to 400 feet per minute, feeds of from 4 to 400 cuts per inch, and 4 to 1,000 revolutions per minute.

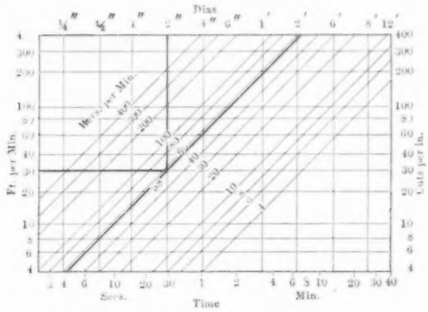


FIG. 2. TO FIND REVOLUTIONS PER MINUTE; GIVEN THE DIAMETER AND SPEED IN FEET PER MINUTE.

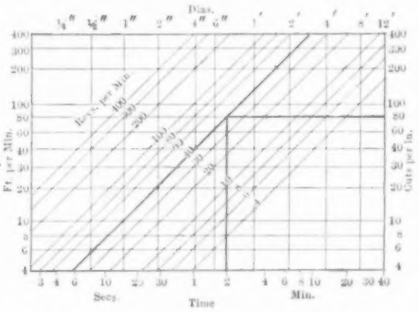


FIG. 3. TO FIND THE TIME TO CUT ONE INCH IN LENGTH; GIVEN REVOLUTIONS PER MINUTE AND CUTS PER INCH.

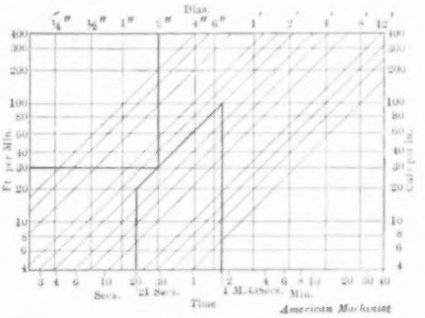


FIG. 4. TO FIND THE TIME TO CUT ONE INCH IN LENGTH; GIVEN THE DIAMETER, SPEED IN FEET PER MINUTE AND CUTS PER INCH.

In order to explain the uses of this chart I have appended Figs. 2, 3 and 4.

Fig. 2 indicates how to find the revolutions per minute necessary to run a shaft of 2 inches diameter to give a cutting speed of 30 feet per minute. Find 2 on the top scale, which is for diameters, and follow down the vertical line until it meets the horizontal line from the left-hand scale denoting 30 feet per minute. Then, at the intersection, the diagonal line gives the revolutions per minute, viz., 58.

The intermediate readings are the same as on a slide-rule, the chart being constructed from a logarithmic scale.

Reference to Fig. 3 will explain how to find the time required to turn 1 inch in length, given the speed as 40 revolutions per minute and the cutting feed as 80 cuts per inch. Locate 40 on the incline scale of revolutions, and from the point of intersection with the horizontal line, from the right-hand scale denoting 80 cuts per inch, follow vertical line down to time scale on base, and read 2 minutes.

Fig. 4 is a combination of the other two diagrammatic solutions, and shows how to ascertain the time required to turn 1 inch in length, given the diameter, the cutting speed in feet per minute, and the feed in cuts per inch. Assuming a diameter of 2 inches and a cutting speed of 30 feet per minute, the diagram gives the times for turning 1 inch with feeds of 20 and 100 cuts per inch, the method of operation being as follows:

Find 2 on top scale, follow down vertical line until it meets the horizontal line from the left-hand scale denoting 30 feet per minute, then follow the incline line up or down until it meets the horizontal line from the right-hand scale denoting 20, or 100 cuts per inch, as the case may be, and then from this intersection follow the vertical line down to the time scale, and read 21 seconds and 1 minute 45 seconds, respectively.

Gainsboro, England.

Calculating Back Gear Ratios.

The calculation of back gear ratios to suit different sizes of cone pulleys is a slow and tedious job when undertaken by the ordinary methods, and therefore the approximate formula given below has been evolved to considerably simplify the calculations. It has been used by the writer and by the examples worked out it will be seen that it is accurate enough for all practical purposes.

Generally, when designing a cone with back gear, it is the rule to first settle the dimensions of the cone and then calculate the gearing necessary to give an even variation of spindle speed from the fastest with the gearing disengaged to the slowest with the gearing in, without having too great or too little difference between the fastest speed with the gear and the slowest speed without the gear. As before mentioned, by the ordinary method a lot of calculation is necessary, which it will be useless to enter upon here, whereas by the method shown a formula is obtained into which it is only necessary to insert the known values and then the calculation is merely a matter of simple multiplication and division.

Suppose that the diameters of a five-stepped cone are A, B, C, D and E, E being the largest and A the smallest steps. Assuming the counter cone to be of the same dimensions, the speed ratios would be

$$\begin{matrix} E & D & C & B & A \text{ (counter cone)} \\ A & B & C & D & E \text{ (spindle cone)} \\ (5) & (4) & (3) & (2) & (1) \end{matrix}$$

$\frac{A}{E}$ being the slowest speed.

Calling the fastest back gear speed (6), if the series of speeds is to proceed with an even step when the back gear is thrown in, we must have:

$$(2) : (1) :: (1) : (6)$$

Calling the back gear ratio r and inserting the values of these speeds, we have:

$$\frac{B}{D} : \frac{A}{E} :: \frac{A}{E} : \frac{E}{A \times r}$$

or

$$r = \frac{B \times E \times E \times E}{D \times A \times A \times A} = \frac{B \times E^3}{D \times A^3}$$

Expressed in words, this becomes: The back gear ratio r is equal to

$$\frac{\text{Diam. largest step}^3 \times \text{diam. smallest step but one}}{\text{Diam. smallest step}^3 \times \text{diam. largest step but one}}$$

which, however, is correct only when the counter and spindle cones are of the same dimensions.

If the machine is to be triple geared, the ratio is found by multiplying the double gear ratio (r) by the above; but the above is equal to r, therefore r^2 is the ratio of the triple gear.

An example may serve to make the thing clearer: A five-speed cone, 18, 15½, 13, 10½ and 8 inches diameters, is required to be fitted with double, triple and quadruple gearing. What will be the three gear ratios to give an even variation of spindle speed?

$$\text{Double gear ratio} = \frac{18 \times 18 \times 18 \times 10\frac{1}{2}}{8 \times 8 \times 8 \times 15\frac{1}{2}} = 7.71 \text{ to } 1.$$

Triple gear ratio $= 7.71 \times 7.71 = 59.44$ to 1.

Quadruple gear ratio $= 7.71 \times 7.71 \times 7.71 = 458.28$ to 1.

If in this particular case the counter-

shaft speed is 100 revolutions per minute, the twenty spindle speeds would be:

225	147	100	67.7	44.5	Single.
29.2	19.1	12.9	8.65	5.78	Double.
3.79	2.47	1.63	1.14	.749	Triple.
.492	.321	.218	.147	.097	Quadruple

If the two cones are not of the same dimensions the formula becomes:

$$r = \frac{s_c \times L^2 \times L_c}{C \times S_c^2 \times S}$$

in which

$=$ diameter smallest step but one of counter cone,

$L_c =$ diameter largest step of counter cone,

$S_c =$ diameter smallest step of counter cone,

$L =$ diameter largest step of spindle cone,

$S =$ diameter smallest step of spindle cone,

$C =$ diameter largest step but one of spindle cone.

For example: A cone 11, 9, 7 and 5 inches diameters is driven by a counter cone 13, 11, 9, 7 inches diameters; then

$$r = \frac{9 \times 11 \times 11 \times 13}{9 \times 7 \times 7 \times 5} = 6.42.$$

Yorkshire, England. A. C.

The Weight of Flywheels for Alternating Current Units.

BY J. BEGTRUP.

A slight variation from absolute steady-motion is unavoidable on account of the variable tangential impulses received by the crank of a steam engine, and this becomes of some consequence in direct-connected alternating current units.

In order to keep the small periodical variations within certain fixed limits a certain amount of energy must be stored in the flywheel and in the revolving armature or field of the generator.

The "moment of inertia" means the mass multiplied into the radius of gyration squared. This, in our case, is proportional to the weight multiplied into the mean diameter squared, and these quantities may be determined by means of the following formula:

$$W D^2 + W_1 D_1^2 = \frac{14{,}000{,}000\, H\, U}{N^3\, V}$$

in which

$W =$ weight of rim of flywheel in pounds,

$D =$ mean diameter of rim in feet,

$W_1 =$ weight of armature in pounds,

$D_1 =$ mean diameter of armature in feet,

$H =$ rated horse-power of engine,

$U =$ a factor of steadiness,

$N =$ number of revolutions per minute,

$V =$ maximum instantaneous displacement in degrees, not to exceed 5 degrees divided by the number of poles on the generator, according to the rule of the General Electric Company.

VALUES OF THE FACTOR U.

For simple horizontal engines, length of connecting rod $=$ 5 cranks, $U = 90$; (ditto, no account being taken of angularity of connecting rod, $U = 64$); cross compound horizontal engines, connecting rod $=$ 5 cranks, $U = 51$; ditto, vertical engines, heavy reciprocating parts, unbalanced, $U = 78$; vertical compound engines, cranks 180 degrees apart, reciprocating parts balanced, $U = 60$.

The most interesting conditions are here exhibited by the different values of U. In the first place, the influence of the connecting rod is remarkable. Assuming the possibility of transmitting power from the cross-head to the crank without a connecting rod, we should in that case have $U = 64$ for simple horizontal engines, but with a connecting rod 5 times as long as the throw of the crank we have $U = 90$, and intermediate values may be had approximately by interpolation. The influence of the connecting rod is due to the angular positions it assumes, by reason of which it imparts unequal tangential impulses to the crank-pin at corresponding points of the forward and backward strokes. Next the different values for horizontal and vertical engines will be noted. The great difference in these values is due to the weight of the reciprocating parts, which are supposed unbalanced in the vertical engine. This weight accelerates the motion on the down-stroke and retards it on the up-stroke. The entire period of this disturbing force, therefore, coincides with the revolution of the crank, while the period of other disturbing forces are limited to one-half revolution, and, as the effect of an effort is proportional to the square of its period it will be understood why the unbalanced weight becomes of so great consequence. In the reciprocating parts are included piston and rod, cross-head and connecting rod, except the crank end, which, as a revolving part, may be perfectly balanced by counterweights. I have assumed the aggregate of reciprocating weights to be equivalent to 11 pounds per square inch of the high-pressure piston and 4 pounds per square inch of the low-pressure piston. Such heavy parts are occasionally used, but they are often much lighter. Part of it may be balanced by having the steam cut off later on the up-stroke and earlier on the down-stroke, and some of it may be balanced by a counterweight in the flywheel if the foundation is solid. By such expedients the factor U may be considerably reduced.

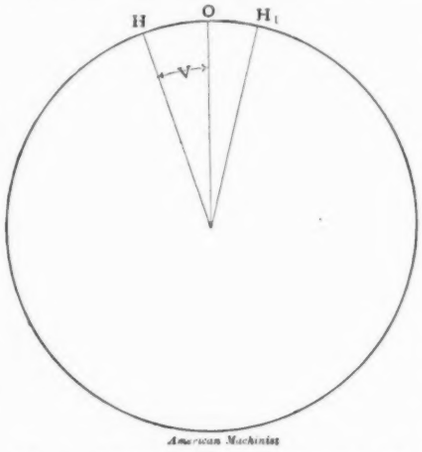


FIG. 1. ANGULAR DISPLACEMENT OF AN ARMATURE.

EXAMPLES.

For a 1,000 horse-power horizontal cross-compound engine, 120 revolutions per minute, $V = 1/10°$, $U = 51$ gives:

$$W D^2 + W_1 D_1^2 = \frac{14{,}000{,}000 \times 1000 \times 51 \times 10}{120^3} = 4{,}145{,}000.$$

Suppose $W_1 D_1^2 = 1{,}000{,}000$, then $W D^2 = 3{,}145{,}000$, and if $D = 14$, $W = 16{,}000$.

Now suppose this to be a vertical engine with heavy unbalanced reciprocating parts, then $U = 78$ and $W = 27{,}300$; that is, 11,300 pounds are needed in the flywheel rim to neutralize the effect of unbalanced parts.

Suppose it to be a simple engine, or tandem compound, connecting rod $=$ 5 cranks, then $U = 90$, $W = 32{,}300$ pounds.

Now suppose it to be a vertical compound with cranks 180 degrees apart, then the angularity of the rods has no disturbing effect, for such effects then neutralize each other at opposite points in the strokes. The result is, in fact, a little better than it would be if we had entirely ignored the angularity of the rods. In this case $U = 60$, $W = 19{,}800$. The preponderant weight of the low-pressure side is supposed balanced, otherwise the wheel will be somewhat heavier. In these examples the valves are supposed to be set so as to give equal cut-offs in both strokes. The point of cut-off is not of much consequence if it corresponds to the value of the factor H in the formula. The effect of inertia of the reciprocating parts is of very little consequence in this connection. The variation in weight of flywheel required for different types of engines is greater than shown by the corresponding values of U, for the moment of inertia of the generator is a fixed quantity, and all the difference the formula calls for will be in the weight of the flywheel. A reduction of the size of the flywheel is often feasible, but only between narrow limits if the weight is to be taken into account. The rotative speed of the engine is of great consequence, for it will be noted that it appears in the formula in the third power, and high-speed engines may therefore have very light wheels.

The irregularity caused by unbalanced weight and angularity of the connecting rod will increase the angular deviation of the revolving field more or less in *one direction*, and this makes such disturbing elements of so great consequence for alternating current generators.

Let the circle, Fig. 1, represent the outline of the revolving field of the generator, and let O be a point on a circle concentric with the field but revolving at a perfectly uniform speed—the mean

speed of the generator. A point on the generator circle corresponding to point O on the other circle will continually change its position relative to point O; at one moment it will be a little ahead of this point and the next moment it will be a little behind it; that is, the motion of the armature is oscillatory relative to the imaginary steady moving circle. Let $H\,H$ represent the amplitude of the oscillation. Generally arcs $O\,H$ and $O\,H_1$ are not equal, let

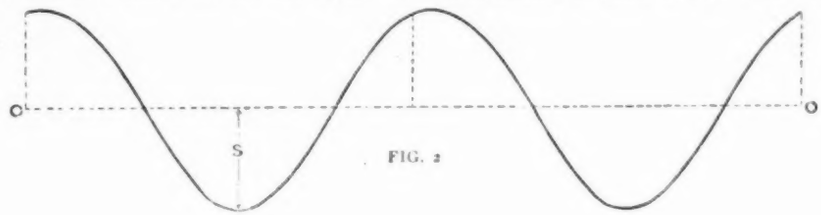


FIG. 2

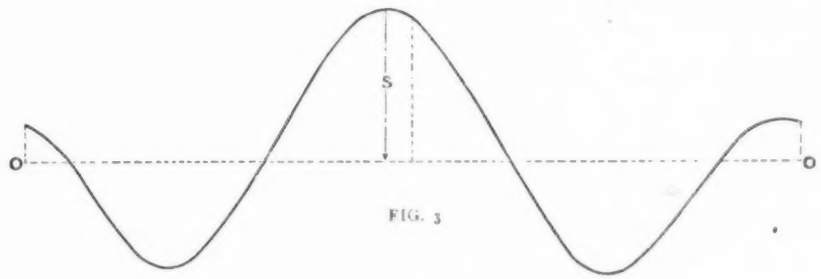


FIG. 3

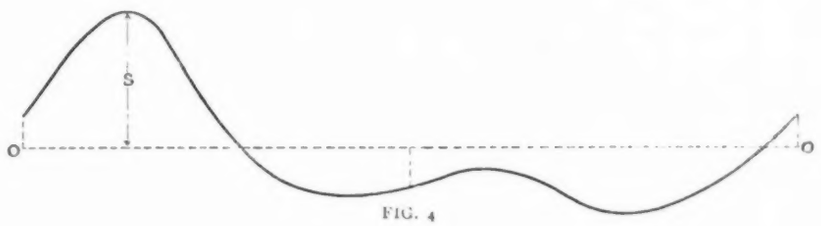


FIG. 4

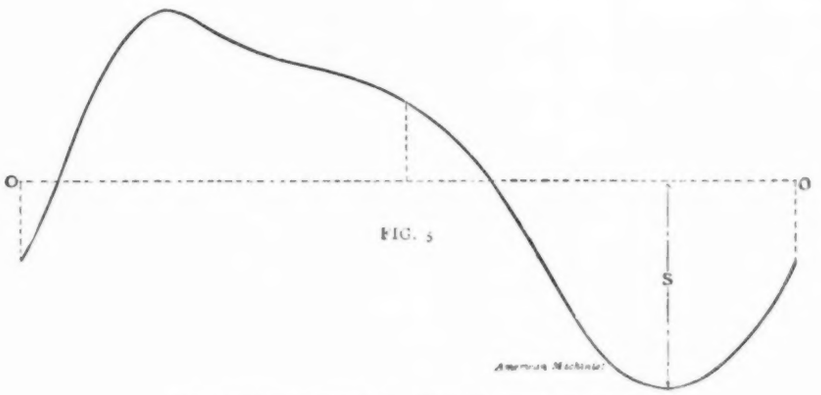


FIG. 5

DISPLACEMENT CURVES OF VARIOUS TYPES OF ENGINE.

$O\,H$ be the greater arc, then it represents the maximum angular deviation from steady-motion; which, according to the rule of the General Electric Company, should not be greater than 5 degrees divided by the number of poles of the generator, and which in my formula is denoted by the letter U.

The determination of the various values of the factor U involves considerable labor. A curve representing the varying rotative effort during one revolution is drawn; from this, by graphical integration, a velocity curve is constructed, and from this the displacement curve is obtained, also by integration. Fig. 2 shows the displacement curve for a simple engine, as it would be if no account were taken of the angularity of the connecting rod, and Fig. 3 shows the displacement curve as it appears when the connecting rod is duly considered. $O\,O$ is the line of steady-motion corresponding to point O, Fig. 1, and ordinates from this line represent the angular variation. The line $O\,O$ must be drawn so as to make the aggregate of areas above and below it equal. The greatest maximum displacement is denoted by S in the figures. The abscissa may represent the rectified crank circle, or simply the time of one revolution. Fig. 4 represents the displacement curve for a horizontal cross-compound engine, and Fig. 5 for a vertical cross-compound with heavy unbalanced reciprocating parts.

The construction of these curves is fully explained in a paper by J. I. Astrom, represented at the Milwaukee meeting (May, 1901) of the American Society of Mechanical Engineers, and in the discussion Mr. Abbott explains a simple drafting-room method. This subject is also discussed by Walter I. Slichter in a paper read at the meeting of the American Institute of Electrical Engineers, New York, October 25, 1901. By these curves the angular displacement can be accurately determined, while my formula gives only approximate values. For a first estimate my formula is sufficient, and the result will in any case be on the safe side, unless the connecting rod is shorter than 5 cranks. Also when the curve has been plotted and the angular deviation calculated my formula may serve to check the result.

It will generally be found that flywheels are heavier than my formula calls for—often much heavier—not for alternators alone, but for all purposes, and that they are made of the same weight for horizontal and vertical engines. The graphic methods here referred to, and which I have used for the determination of the factor U, are absolutely correct and may be trusted as implicitly as the Newtonian laws on which they are based. Why then this waste of cast iron and unnecessary dead weight on bearings? May it not be that something else but the small angular variations determines the weight of flywheels? The flywheels for direct-current generators are now generally made much heavier than would be necessary for the degree of steadiness as letermined by the electricians for alternating current generators. The action of the governor is intimately connected with the inertia of the flywheel, and may not the governor have some important bearing on this flywheel question?

The small periodical variation in velocity (not angular displacement) can be determined from the following formula:

$$F = \frac{387{,}700{,}000\ H\ Z}{N^3\ (W\ D^2 + W_1\ D_1^2)}$$

in which

H = rated horse-power,
Z = a factor of steadiness,
N = revolutions per minute,
D = mean diameter of flywheel rim in feet,
W = weight of flywheel rim in pounds,
D_1 = mean diameter of armature or field in feet,
W_1 = weight of armature,
F = variation in per cent. of mean speed.

VALUES OF Z.

For simple engines and tandem compounds, $Z = 16$; for horizontal cross-compounds, $Z = 8.5$; for vertical cross-compounds, heavy reciprocating parts, $Z = 12.5$; for vertical compounds, cranks opposite, weights balanced, $Z = 14$. F represents here the entire variation between extremes—not variation from mean speed. It generally varies from one quarter of

one per cent. of mean speed to three-quarter per cent.—evidently a negligible quantity.

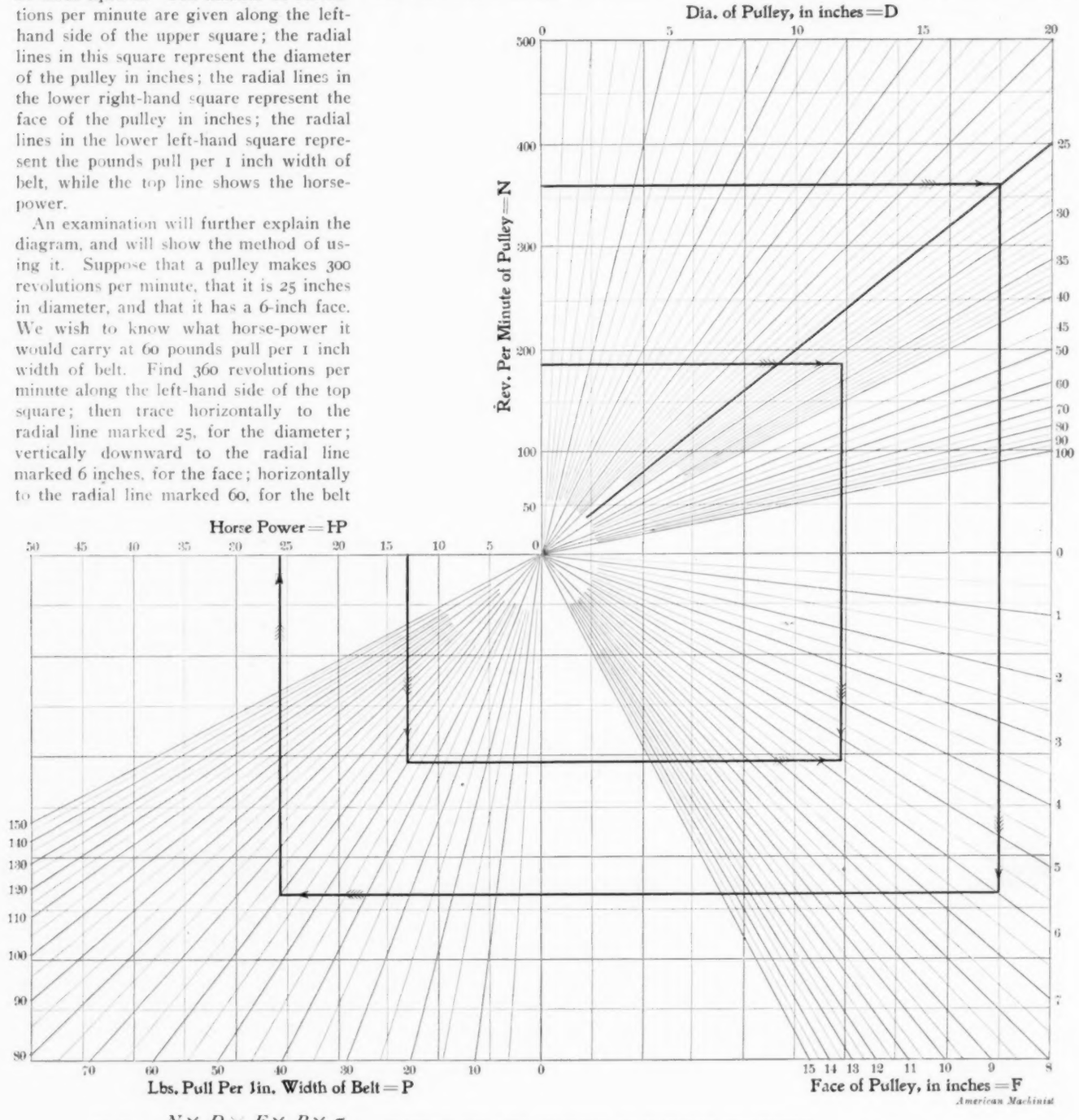
A Diagram for the Solution of Problems in Belting

BY FRANK B. KLEINHANS.

The accompanying diagram is made up of three squares. The number of revolutions per minute are given along the left-hand side of the upper square; the radial lines in this square represent the diameter of the pulley in inches; the radial lines in the lower right-hand square represent the face of the pulley in inches; the radial lines in the lower left-hand square represent the pounds pull per 1 inch width of belt, while the top line shows the horse-power.

An examination will further explain the diagram, and will show the method of using it. Suppose that a pulley makes 300 revolutions per minute, that it is 25 inches in diameter, and that it has a 6-inch face. We wish to know what horse-power it would carry at 60 pounds pull per 1 inch width of belt. Find 360 revolutions per minute along the left-hand side of the top square; then trace horizontally to the radial line marked 25, for the diameter; vertically downward to the radial line marked 6 inches, for the face; horizontally to the radial line marked 60, for the belt pull, and vertically upward, and read off the horse-power along the top scale. It is found to be 25.7 horse-power.

Another example will show another application of the diagram. We wish to transmit 13 horse-power from a line shaft, running 185 revolutions per minute, the diameter of the pulley, to give the proper speed, being 32 inches, and the highest permissible belt pull being 50 pounds. What would be the width of the pulley face to transmit the 13 horse-power? First—Find 180 revolutions per minute on the vertical scale; trace as before, to the line 32, for the diameter, then vertically downward as shown by the arrow. Second—Find 13 horse-power on the horizontal scale, trace vertically downward to the line 50, for the belt pull, then horizontally to the intersection with the previous line as shown by the arrows. The point of intersection of these two lines gives the face of the pulley, which in this case is 5.53, or 5½ inches.


Dia. of Pulley, in inches = D
Rev. Per Minute of Pulley = N
Horse Power = HP
Lbs. Pull Per Iin. Width of Belt = P
Face of Pulley, in inches = F
American Machinist

$$\text{H. P.} = \frac{N \times D \times F \times P \times \pi}{12 \times 33{,}000}$$

DIAGRAM FOR THE SOLUTION OF PROBLEMS IN BELTING.

Echoes from the Oil Country.

THE WAYS OF SALESMEN.

"Good morning, sir; good morning. I believe this is Mr. Osborne, is it not? I am glad to know you; very much pleased to know you indeed. I represent the International Soft Soap Company; we make the best grade of strictly pure soft soap in the market. As you are an intelligent man, I know you want only the best. May I inquire what brand you are using at present?"

I replied that I had not paid much attention to the brand, as we had used very little and got that from a local dealer.

"You can effect quite a saving by a lib-

eral use of soft soap, I assure you. It will do instead of lard oil and soda water, and will sometimes even take the place that might otherwise be occupied by a law suit. Let me send you half a barrel on trial, and if you are not thoroughly convinced in your own mind that it pays to use it, return it at our expense and don't pay a cent for it. You see you run no risk as we will prepay the freight and you will find your corn-shellers improved in every way by the use of it. It will be easier to build them, easier to sell them, and also easier to collect the pay for them, and I have no doubt that you can also get a better price for them. They are fine machines now, and by using our soft soap they will simply outclass anything else on the market.

"Let me see, what is the full firm name? I want to be sure, as there are some people making such poor corn-shellers that we do not care to deal with them and I want to be certain this comes direct to you."

My feeble protest that about two pints a year was about the amount of soft soap used by us and that I used most of it to shave with did not help me, for this was going to come strictly on trial and at their expense. In due time there it was ready for use and, as condemnation without trial would hardly be fair, ways and means of using it were sought for, and it was really surprising to find how many uses could be found for it. Suffice it to say that in time, as our business grew, it became a regular article of consumption with us. We did not use very much, like the Steel Trust or some other large concerns might need to do, but always kept a little on hand for such places as needed it.

. . . . . .

"I am selling the Universal Soft Soap, which of course you well know is the finest grade made by anyone; you no doubt will be interested in it. The brand you are now using is a very good one, but when you want the best our brand is the one. I want to send you a barrel on approval and will leave it entirely to you to know whether it is not better than anything you ever used." This man evidently wishes to help me, but I am not a competent judge of soft soap and tell him so.

"Oh, that doesn't matter, not in the least; the superiority will be so marked that you will have no trouble to know which is best; you will get a much better article, and I know when you once get started on our brand you will never use any other." And in due time along comes another barrel.

. . . . . .

"Allow me to encroach on your time for a few minutes. I know you are an exceedingly busy man and your time is valuable, but I have something here that cannot fail to interest you. I am introducing the Sassafras Ridge Soft Soap. This is the finest grade ever produced. It is used by the United States Government and all of the other enlightened, highly civilized governments of the world. Wherever it is once used they will have nothing else at any price. A trial is all that is needed to convince the most skeptical of its superior merits. The material used in its manufacture cannot be obtained by our competitors, as we buy up all the the finest soap fat in the country and they have to take what is left. Besides that, this brand is made by a secret process that is known to but three men, and they are our president, treasurer and general manager. It cannot be analyzed, as the ingredients change their nature in the process of manufacture and some of the most essential ingredients are entirely eliminated, but they are absolutely essential in getting the results. The price is higher than others; that, you know, would naturally follow. From the care used and quality of the material it could not be otherwise, but the results are so far ahead of anything else ever obtained that it is really very much cheaper at this price than the ordinary kinds.

"There is another thing: All the prominent manufacturers use it." He rattles off a string of names that sounds like a list of the advertisers in the AMERICAN MACHINIST, and throws in a few extra from the —— —— and *Power*.

"You couldn't get any of them to use anything else, not if you gave it to them for nothing. People who use it stand in a class by themselves. It gives a standing to a machine. Just there is an advertisement. 'Nothing but Sassafras Ridge Soft Soap used in the manufacture of these Squeezers.' Don't that look well? We advertise so extensively that our brand is the best in the world, and remember this, sir, remember this: we absolutely make only one kind. You get exactly what is furnished to Uncle Sam for use on his warships. He has the finest corps of experts in the world, and you can know that when they test and adopt anything they have full knowledge of everything else of the kind in the world and they want only the best—but I am taking up too much of your time. How many barrels will I send you? Mind, if it is not all and more than I have said, send it back at our expense. It don't matter if you have used three-quarters of it. We want you to use it in the very worst places you can find. If you have a customer that always kicks about paying his bills, use a little judiciously on him and you need not be surprised if he insists on paying twice what he owes.

"What! you really don't mean that you don't want any of it? You cannot afford to be without it. To prove its merits, I tell you what I will do: Let me take some of your work and I will send it in to our works and have them finish it with our material free of all charge and we will pay charges both ways. You can test it in every way, and if you find it just as I tell you, of course you will see that it is greatly to our advantage to get together and for you to get your material from us."

Surely it was poor policy to let such a philanthropist go without an order, but my stock of soft soap was large, and I had tried to make a few tests on various other matters and had begun to realize that a test to prove or disprove anything to one who was only interested in knowing the truth was far from being a simple matter even with as simple a substance as soft soap; besides that, I had about as much work on hand as I could conveniently attend to and my time making and keeping track of a good, thorough test would be worth as much as the entire saving possible in ten years, so I had to refuse to take advantage of this golden opportunity.

. . . . . .

"This is just what you have been looking for. It is the old reliable soft soap such as our grandmothers use to make. There isn't any patent on it or any mystery about it. Anyone can make it that has the material and wants to go to the trouble. We buy the material and make it up in large quantities, and I think I can sell it to you almost as cheap as you can buy the material, and certainly much cheaper than you can make it; besides, I know we are more likely to have each lot uniform. If you want to pay extra for perfume or color and will let me have a sample of what you are using, we will duplicate it for you and guarantee that it will be exactly as the sample furnished."

This so impressed me that I took down prices for future reference.

. . . . . .

"Can't I interest you in the subject of soft soap to-day? You say Blank's man was just in. Blank makes a good soft soap and sells it at a reasonable price, and I haven't a word to say against either him or his house. He isn't like some of those fellows that try to buy you to let them sell you, and try to befuddle you with their talk of mystery when there isn't any. We have analyzed every brand of soft soap on the market to-day, and there isn't any that cannot be duplicated by any good reputable maker. If you are using Blank's and it is suiting you, I don't see why you should change unless I can save you a little on freight rates or give you quicker delivery; however, if you ever want to change, please give us a trial and we will try to take care of you. Good day."

I am sorry I don't know all about soft soap and be able to tell you that may need it which brand is the best. I did not think there were so many people making it, neither did I consider it so essential in the corn-sheller business, as some of them seemed to think it was. However, I am young in the business as yet; possibly that is why such things impress me.

I begin to find out that there are many, many things of much greater importance to me than getting absolutely the best of

anything, unless that best is clearly a demonstrated matter and so accepted by the trade generally.

To go by the inventors' or manufacturers' ideas only, seems out of the question, while to keep on trying everything that comes along is equally out of the question. That would result in uncertainty of working and of output that would cost more, often, than would be gained if the various things tried were always furnished free.

As long as the corn-shellers sell for a little more than they cost and lots of people want them, we are getting ahead some without plunging, and if any of my friends have things better than I have I am going to profit all I can by their experience if I can see how to do so with my work. In the meantime I suppose I will still receive occasional visits from the soft soap men, several of whom will be supplying the entire wants of all the prominent manufacturers of the country and will be told that of all those making corn-shellers I am the only one that cannot see his way clear to use their goods.

Why I will persist in letting the golden moments pass me will, perhaps, finally be a mystery to them, just as the problem which is a right and which is a left hand side tool is to the ordinary machinist.

I am glad salesmen are not as thorough hypnotists as those that give public exhibitions, as we need a little space to work in and a little time not taken up by tests in which to make a few corn-shellers.

W. OSBORNE.

A Philippine Machinist.

A correspondent of *The Blacksmith and Wheelwright* saw this sign in the Philippines. It belonged to a native blacksmith

A SIGN IN THE PHILIPPINES.

who, it may be supposed, wished to suggest either that he would shoe horses in the American style or that he would shoe the horses of Americans. "Hoof Machinist" suggests, in a way, a repairer of automobiles, but that would hardly apply in this case.

We have received an elegantly gotten-up pamphlet entitled "International Arbitration and Reciprocity," which contains an article on that subject originally written for the *New York Times* by Mr. William F. King, ex-president of the Merchants' Association of New York, and which is well worth the reading by those who are interested in international trade, as of course most of our readers are.

Letters From Practical Men.

Average Drawing Room Practice.

Editor American Machinist:

The article by C. E. Coolidge, at page 874, leads me to say that twenty years' close observation and experience at the drawing board, pattern bench and lathe has educated me on the drawing question.

Not long ago I had a pattern to make from a ¼ scale drawing. When possible I lay my work out full size, which I find a great help as I go along with the work on the pattern. I started to make this drawing full size, but had not proceeded far when I was obliged to stop, and, to put it mildly, I was disgusted. I was obliged to call the foreman to explain some of the measurements which were not put down on the drawing. After looking the drawing over the foreman called the draftsman to explain, who said he did not put the measurements on the drawing for the reason that he made so many drawings for the same kind of work he thought every person connected with the pattern shop understood the drawing so they could make the pattern with the few measurements given.

This is a great mistake. Patternmakers do not remain in one shop a lifetime. The old ones who understand the drawings as they are made and the shop methods in general, leave and new ones take their places. The new man is given one of these half-finished drawings and right from the start is obliged to ask questions. A good mechanic will not start work until he understands the drawing, and this he cannot do with an indistinct or half-made drawing. Nothing disgusts a good mechanic so much as to be obliged to call the foreman to explain a drawing, and nine times out of ten he will take a chance on its being right rather than bother the foreman, because he knows the foreman will soon get disgusted with him if he bothers him too much.

A draftsman is asked to make a drawing of a machine or part, and from a mental conception to a finished drawing he understands every part and line on the drawing so well that he can carry on the work of construction without looking at the drawing. Nothing stops him from putting down lines and figures but the want of space until the drawing looks like the water lines on an Atlas map, he never stopping to ask, "will the workman understand this when he gets it?"

I would suggest for the average drawing-room practice: A clear, plain *working* drawing for the foreman; a clear, plain *detail* drawing for the workman; all notes such as *bore, finish, brass, iron (gray or malleable), aluminum, steel, etc.*, in clear, plain English. In this way the patternmaker will know what is meant. *Bore* is bore and *Fin.* is finish, understood by all. Always keep in mind that from your drawings the *ordinary every-day mechanic* will get his information. Special fancy drawings with figures, symbols, characters, etc., understood in college may be all right, but for every-day shop work *put everything down in English.*

MACHINIST.

To Identify Steel.

Editor American Machinist:

I have no doubt that you and many of your readers have, like myself, been very much annoyed at times, by receiving a piece of steel from the toolroom or stock room supposed to be tool steel, and finding out after spending more or less time upon it, that it was only machinery steel. Now, perhaps our wise companion will ask, "can't you tell tool steel from machine steel, or one kind of tool steel from another?" to which we may answer "yes" and "no." If we care to take the trouble to give each piece of steel the fire and water test, we certainly can tell; but it isn't as easy to recognize one brand of steel by the external appearance as it might be in determining the species of trees by their bark, and there are not many of us who can do that even. "Isn't there a difference in the way these steels work up that would give a hint then?" asks our friend again. Yes; usually machinery steel works up much easier than tool steel, but when you have got "soft" tool steel and a machinery steel that is inclined toward hardness, the differences are none too clearly defined.

One firm painted the ends of their bars of steel two different colors to distinguish tool steel from machinery steel, and on the steel rack was this notice inscribed: "Do not use the painted ends of these bars. By order, Superintendent."

To overcome all of the difficulties arising from such mistakes, I had all of the tool steels striped with a distinct color for each brand used, whether flat or round. For example: Hobson's, yellow; Howe-Brown, brown; Sanderson's, white; Styrian, purple; Gold Label, pink; Crescent, pea green, etc., the stripes running the entire length, and it mattered not how long or short a piece was cut off, it could be easily recognized by its color. The shelf in the rack occupied by any particular brand of steel was marked by having the name of the maker painted thereon in the same color as used in striping the bars, and at the window another card was prepared giving the makes of steel and the colors by which they are designated, so that the party receiving the piece could satisfy himself that he was receiving what he called for.

When a new lot of steel arrived it was cut up into lengths not over 8 feet long, and a stripe of paint of the proper color was run the full length, and the bar placed in its proper place in the rack, which was only 8 feet long. Now, anyone wanting any tool steel could call for it either by name or by the color of the stripe it bore. Machinery steel was left just as it arrived,

also Stubs steel, and as we only used it in sizes up to ½ inch diameter, all cold-rolled steel up to that size was ordered "coppered," or else we gave it a coating with the usual bluestone solution. Thus it was an easy mater to distinguish any particular brand of steel whether care had been exercised in replacing it on its proper shelf or not, and as to the profitableness of the scheme readers can judge for themselves. E. A. R.

A Special Rig for Cutting Bevel Gears on the Milling Machine.

Editor American Machinist:

The device of which I enclose a sketch illustrates a convenient and practically accurate method of cutting bevel and miter gears on a milling machine. It is a modification of a similar device which I have seen in use in other shops.

A gear planer is undoubtedly the only tool that will produce a theoretically correct cone gear, but since this tool is of necessity an expensive one it happens that numerous shops are not equipped therewith.

For the benefit of the readers of the AMERICAN MACHINIST, and more particularly for the benefit of those who are called upon to produce bevel or miter gears on a milling machine, I send you this device, which has given absolute satisfaction in the shops of the American Tool Works Company and by the use of which I have produced gears second only to those cut on our Gleason gear planers.

The principle upon which this device is based is the same as that of an ordinary dividing head. Referring to Fig. 1, which is a side view, and to Fig. 2, which is an end view, piece *R* is a base plate which carries an angle plate *M*. The piece *R* has a tongue fitted into the tee slot of the platen, which insures perfect alinement. The angle plate *M* is just 1 inch narrower than the inside measurement of plate *R*, the space on each side being filled up by two pieces of ½x½-inch steel, which brings the head central.

The operation is briefly as follows: Place a center in the dividing head, center the proper cutter for the gear which is to be cut, and set index ring on cross-slide screw to read zero.

The two index plates *A* and *B* are then adjusted, the notches in one being advanced beyond those of the other plate, suitable slots *P* and binding screws *O* being provided for this. This advancement we will term the roll and it must be determined by experiment. The gear blank is then put on a taper plug held in the dividing head spindle, the pull pin *C* is placed in one of the notches of the inner plate *B* and the cross slide of the milling machine is moved by an amount equal to one-half the thickness of the cutter on the pitch line. The setting of the gear to the proper cone angle is readily accomplished by observing the graduations on the top of plate *M*. The cutter is next set so that it touches the gear blank on its largest diameter, the knee of the machine is adjusted to the proper depth of tooth and the machine is ready to cut all around, using the index plate *A*. Having cut once around the pull pin is adjusted by means of slot and binding screw *D* so that it comes in line with index plate *B* and the cross-slide is now moved out from zero the same amount that it was moved in during the first operation and the gear is cut all around as before using the index plate *B*. If the gear teeth are too thick at the pitch line, give the index plates more or less roll, as the case may be. Having determined the proper roll, the two ind x plates can be doweled together to preserve the adjustment for future use.

Instead of moving the cross-slide in and out for every gear, the blocks *K* and *L* may serve the useful purpose of positive stops. For this purpose reduce these pieces the number of thousandths that the cross-slide is to be moved, which can be read from the index collar on the screw. If the cross-slide is placed on zero and one of the blocks is interposed between ledge on plate *R* and the angle plate *M*, and the angle plate *M* is moved up against same, the same result is obtained as by using the cross-slide of the machine, while all danger of mistakes due to incorrect reading of the micrometer dial is eliminated.

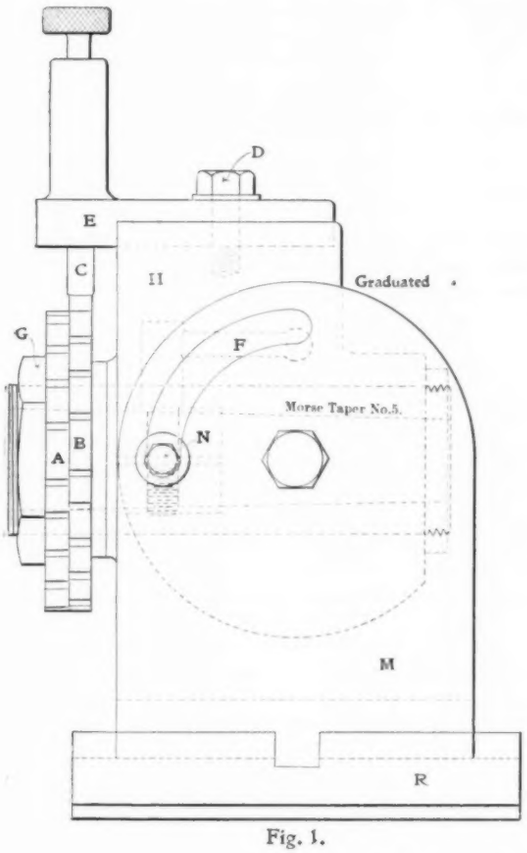


Fig. 1.

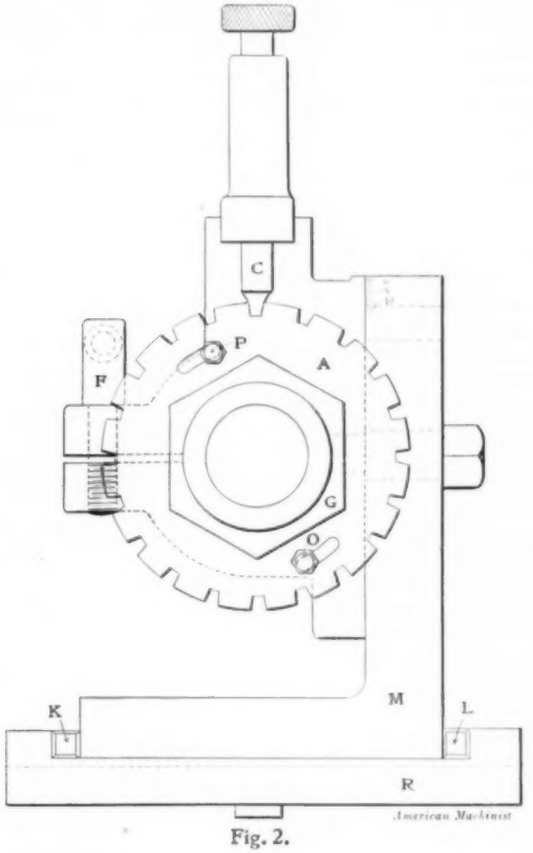


Fig. 2.

A RIG FOR CUTTING BEVEL GEARS ON THE MILLING MACHINE.

With this system I have cut 72 steel miter gears 20 teeth, 10 pitch, 5/8 inch face, in 36 hours, all gears being absolutely alike, which could not have been attained by ordinary methods.

EDWARD R. CONNERS.

Roller Bearings.

Editor American Machinist:

I notice the article of S. P. Y. at page 851, and his experience is in the line of trouble I have had. I made a small compressed air drill engine, and used roller and ball bearings. In a week's use at a shipyard the tool was worn out. Still unconvinced, I applied them to a small engine crankshaft, and in a month ruined crankshaft and steel bushing. After I had become suspicious of roller bearings, I became associated with an agricultural implement company who were trying them on plow wheels which were under some pressure. After warning them that the bearings would fail when made as they were of cast iron bored out and no bushing, I was instructed to arrange test bearings and note the result. I mounted the wheels so as to take some thrust, as in actual use, but they gave out by cutting and abrading the soft metal in very short order. Hyatt elastic rolls with soft steel bushing gave the same results, the axle cutting. I do not think this roller is kept in good enough alinement for heavy work having any possible lateral thrust. The bearings that had been placed in the field by the people I refer to failed, and were eventually all replaced—if the entire machine did not come back upon the makers. I do not think ball or roller bearings are desirable in any place run by power, or under any heavy presure. The number of bicycle bearings which give out from the breaking down of the race, cone or balls is a very large percentage—50 to 75 anyway—but the sensitive foot of the rider early detects the trouble and it is repaired; but put under the insensible belt sad damage will often happen before the trouble can be located. I understand a windmill company put out a large number of windmills with roller bearings with very unfavorable results.

I am therefore an advocate of oil and plenty of it, and believe a fraction of the expense of a good roller bearing expended in oil and oiling devices will give a great deal better results. In my crusade I have been met by one pretty hard fact. The harvesting machine people use them by the million in soft cast iron, soft rollers, soft shafting, and sometimes under good pressure. My theory is that in a majority of cases the pressure is very small and that with plain bearings the draft of these machines is friction and that, the friction relieved, the work is enough easier to compensate. Another thing is that the working life of these harvesting machines is rarely over sixty to ninety days, and often not over thirty. If that kind of efficiency in machine tools would answer, perhaps roller bearings would do.

It is a rather startling proposition at first to say that we are manufacturing millions of machines in this country with an average life of only, say, sixty days' work, but I think investigation will bear me out. In New York State a mower, like those made by McCormick or Deering, will last five to twenty years, but the capacity of these machines is ten to fifteen acres per day and the average cutting on a great many farms will not run over fifteen to twenty acres per year. So that when the Western man uses the same machine up and buys another, his Eastern brethren think it shiftlessness when, as a matter of fact, he has exhausted the life of the tool. At the same time I cannot explain how those soft bearings last the sixty days—can anyone else?

GEO. L. ROBY.

Editor American Machinist:

At page 851 I noticed S. P. Y.'s request for information regarding roller bearings and citation of several cases in which his experience has been most unsatisfactory. In reply to this I offer my experience with roller bearings of the same make, if I am not mistaken, as those to which S. P. Y. attributes the loss of an order for a 25-ton crane. This experience has been the opposite to S. P. Y.'s.

In the fall of '97 our works had reached the capacity of our engine of 200 horsepower. As a matter of fact we had considerably overreached its capacity and at a time when it was absolutely necessary that there should be no interruption to the running of the plant. The matter had reached the point where it seemed to be simply a question whether we should put in a new engine of double the capacity of the old one or install the Niagara Falls power. The first cost in either case was a stumbling block over which we at once fell, not to mention the extended shutdown which either installation would have caused.

At this point I suggested to the directors and superintendent the advisability of putting roller bearings on our line shafting and was told to take the matter up at once, which I did, and on March 22, 1898, all the bearings on all of our line shafting and a number of countershafts were equipped with the hollow flexible roller bearings and without the loss of a minute of running time.

We have about 800 feet of shafting, three runs of 200 feet each, a couple of 60 feet each, one of 50 feet and one of 45 feet.

Previous to the installation of the roller bearings our friction load by the indicator was 106 horse-power. After they were put in the indicator showed that the friction load had been reduced to 68 horse-power. It doesn't take a very great hand at figures to find the advantage gained by us in this case by the use of roller bearings. At the present time one man can take hold of the rim of a 42-inch pulley and turn either of the 200-foot runs quite easily, and one man on the bar in the engine-room can pry the engine off center without throwing out any of the clutches in the plant—an operation which required half a dozen men before. Our shafting ranges in size from 5 inches down to 1 15-16 inches.

I am at a loss to understand why in the case of the 25-ton crane a roller of only ½ inch diameter was used, as in my estimation this was entirely too small. It would be about the proper size for a 2-inch shaft. I think that the makers of this roller would advise for a shaft 3 7-16 inches diameter a roller of about ¾ inch diameter and correspondingly stronger than ½ inch. It also seems to me that they should have been more carefully looked after and not allowed to become so badly broken and the shaft so badly cut as to require new ones to be put in.

We had a loose pulley in one of our departments which was a continual source of annoyance on account of the bushing running hot and burning out. We had tried babbitt, grey iron, brass and bronze, but all were failures, owing to the high speed (about 450 revolutions per minute) and a necessarily tight belt. Nothing would run over three weeks at the most. Last January I decided to try the roller bearings in this pulley and the result has astonished me. The pulley has given us absolutely no trouble since the rollers were put in.

I have on a sander a spindle 1 inch diameter carrying an idler pulley over which runs a sand belt at a speed of about 6,000 feet per minute, and this also was continually running hot. The hollow flexible roller bearing was also put in this idler pulley and all trouble disappeared.

My experience with the roller bearings has been so satisfactory that I cannot refrain from giving them their full measure of praise. If the proposition is fairly met and all conditions carefully considered, I am positive that S. P. Y.'s opinion of the roller bearing would be directly the opposite of the one which he now holds.

I hope that S. P. Y. may find something in this to interest him, as well as some of your other many readers.

Buffalo, N. Y. E. ARKLAND.

Editor American Machinist:

The remarks of S. P. Y. at page 851 move me to relate some of my experience with roller bearings, in the hope that I may be benefited as well as be of benefit to others. I have fitted up roller bearings for yard trucks and cranes, and formerly it was my custom to take a great deal of care. I used 9-16 cold-rolled steel for the rollers and took special care that the journal boxes were as nearly cylindrical as a good lathe and a good lathe man could make them. I calculated the diameter of the journal box from a table of chords and made the diameter of the box about 5-1000 inch larger than the calculation called for.

This would allow the rollers to go in freely, and at the same time they fitted so closely that they would maintain their position when horizontal—*i. e.*, they did not "cave in." They worked beautifully for the most part, and I am certain increased the efficiency of some classes of machinery very greatly. For instance, a 10-ton jib crane was equipped with plain bearings. There were four falls of hoisting chain, and everything was well fitted and kept well oiled. The trolley was racked by a 5-16 inch chain running over a 6-inch sprocket wheel and a hand chain on a 32-inch sprocket on the same shaft. No trouble was experienced with 2- or 3-ton loads, but when the crane was loaded to its capacity the trolley refused to budge, and the 5-16 inch racking chain broke under the strain. I put roller bearings in the two sheaves in the block and in the three sheaves on the trolley, and the same racking chain (5-16 inch) handled the trolley all right. I also back geared the hand chain about 3 to 1; but note that the same racking chain was used in both cases. No trouble had been experienced the last I saw of it, when it had been in constant use in a foundry for about a year.

I equipped little hand-power travelers with roller bearings of the same type, both in the trucks and in the trolley, and I have frequently seen from 1 to 3 tons pushed along by one man. I have equipped hand-power elevators with roller bearings—cold rolled steel for rollers—and they were entirely satisfactory and seemed to reduce the friction to quite an extent. I once built about 200 lumber trucks for use in drying kilns. They were simply two pieces of channel, about 6 feet long, with a double flanged wheel about 9 inches diameter—perhaps 8 inches diameter—near each end, the channels being held together by three cast separators with a bolt through each one. The wheels were bored 2¼ inches + about 1-100 inch (I never measured them carefully, and always considered the workmanship rather rough). The axle was 1⅛-inch cold rolled steel and no attempt was made to have the rollers just fill the bore of the wheel. There may have been 5-16 inch between the first and last roller, yet these trucks were heavily loaded, and I suppose they were all right, for I never heard of any complaints about them.

Please note that the first bearings described were carefully made—rollers just filled the bore of the box and axles made to just fill the rollers. In the last case—the lumber trucks—the wheels were bored with a double-ended cutter to nominally 2¼ inches, and quite a space was left between the first and last roller, and the job was not a case of fine fitting at all, yet both seemed to be equally satisfactory. No roller cages were used in any of these cases.

I equipped a 5-ton trolley with Hyatt roller bearings, the trolley being 20 feet from the ground and frequently loaded to its capacity. One or two men would put the load any place they desired, and did it easily; but while dynamometer tests might show the Hyatt bearings to be the best, I could not say that they were from my own experience.

I have had quite an opportunity to observe the action of roller bearings along the lines mentioned. It seems to me that on push cars of moderate capacity, say from 1,000 to 10,000 pounds, and on hand-power jib and traveling cranes they are very satisfactory, but for high speeds, as in the case of cars drawn by yard locomotives, for high-speed electric cranes and in places where there is excessive shock and jar, I believe they are a failure. I built a 10-ton core oven car and used cold rolled steel rollers, and it was a dismal failure. I used all my resources to make that car work, but was obliged to give it up. I understand that core oven cars are built with the same kind of a bearing and are entirely satisfactory, but I cannot vouch for it. I saw roller bearings of a certain celebrated make used on the spindles of a stone pulverizer and they failed wretchedly. These spindles were 2 15-16 inches diameter and the bearings were about 14 inches long and were vertical. The shock was very severe, and in some cases they pounded the bearings out inside of an hour.

I do not pose as an expert in this line, but give the results of my experience and observation, which have been somewhat extensive. A. L. Bowen.

Editor American Machinist:

In regard to the letter published in your columns at page 851 regarding the operation of a hollow wound roller bearing used in a traveling crane.

As our company controls all patents covering roller bearings of this type, we are of course interested in the subject, and, in answer to your correspondent, beg to submit the following:

1. The bearing in question was greatly overloaded, the pressure being very close to the crushing strength of the roller. To have been correctly designed for this load, the latter should have been at least one inch in diameter. We have no record of this bearing and question whether it was built by us. It is probable that rollers adapted to an entirely different class of work have been removed from other bearings and used in this instance, for we do not furnish bearings without obtaining full information as to the conditions under which they are to operate, nor do we furnish rollers only, except in very exceptional circumstances.

2. We guarantee our bearings to operate under conditions of speed and load specified, but we are not responsible for bearings that may be rebuilt by irresponsible parties, or that may have operated under work entirely different from that contemplated.

3. As to the efficiency of the roller bearings in general, tests made by the most approved electrical methods will demonstrate a saving in the consumption of power of from 10 to 30 per cent., dependent upon the conditions. Such means are absolute and cannot be contradicted, while we question the accuracy of the methods adopted by your correspondent.

We would appreciate such information as would enable us to determine how a bearing of that size could have been obtained for that duty. It is needless to say that it was not recommended by us; in fact, we should have refused to furnish such a bearing for that duty had we been asked to do so.

Trusting that this will explain the occurrence to the satisfaction of your correspondent, we remain,

Hyatt Roller Bearing Company.
Alfred P. Sloan, Jr., General Manager.

Trade Schools.

Editor American Machinist:

I have read with interest the letters which you have published regarding trade schools, and, as it is a subject in which I am deeply interested, I would like to express my ideas on the same.

I believe that every shop employing apprentices should require these boys to attend a night school, say, three evenings each week, where they would be taught the common branches of education such as they are capable of taking, with special attention to practical lessons. For instance, in teaching English, see that the student is taught how to express himself regarding shop matters, such as making out requisitions and making notes relative to his work. The mathematics should have practical problems relating to the work to be done. Sketching and elementary drawing could be taught sufficiently to give a boy an idea of how to make a sketch of a piece which might fall in his line of work, and how to make clear notes on the same.

At the end of each year, or some other convenient period, require the boy to stand a good practical examination on the subjects and let his grades count a certain per cent. towards his standing as regards wages. If he is to have an increase of salary each year, let the examinations have their weight along with the ability with which the shop work is done.

My idea of the method of carrying out this plan is this: The salary of the engineer or draftsman in the shop should be such that he can be required to give about nine hours per week to this class of work as a teacher. Of course, the attendance on the part of the boy being compulsory, he should not be required to pay a tuition fee. I believe the increase in salary of the teacher would be more than returned to the company by the better work the apprentices will turn out. If a boy pursues such a course for a few years he will be capable of laying out any class of work which falls to his lot, as well as able to work from complicated drawings. How

many of our mechanics to-day are able to do this? I feel safe in saying that at least 50 per cent. cannot. It has been my experience that, where one carries along with his trade work, study of those branches of science that give him an insight into the reasons for his doing a piece of work this or that way, there is much more interest taken in the work, and consequently a better class of work is turned out with a decrease in time. E. F. SCOTT.

[Our correspondent informs us that while serving an apprenticeship as a patternmaker he attended an evening school and thus fitted himself to enter an engineering school, and that, in due season, he obtained an appointment as an instructor in patternmaking at such a school and thus supported himself while taking a full course of study in engineering, from which he is now within a year of graduating. This sort of man is entitled to have some opinions on this subject.—Ed.]

Layout for a Reciprocating Motion With a Pause at Each End.

Editor American Machinist:

In the design of an automatc machine recently, it was desired to use a reciprocating motion with a pause at each end of the stroke. After some discussion, during which a slotted connecting rod was discarded as too noisy and likely to hammer the machine to pieces, and a modification of the heart cam was objected to on account of its cost (there isn't any cam-cutting attachment in the shop), the man next to the writer came to the rescue with the arrangement shown in Fig. 1, saying he had used it once before.

In this case a quick return was inadvisable, so the writer finally adopted the arrangement shown in Fig. 2, which is substantially the same thing. For the purpose it filled the conditions perfectly, being easily laid out and easily made. An inspection of Figs. 1 and 2 will show that the pause is accomplished by the arcs whose pitch line is an arc of the circle traveled by the crank-pin center, and that the number of degrees cut off by these arcs can be varied within quite wide limits, thus giving almost any desired pause. In both figures the pause is 60 degrees, or 1-6 of a revolution.

Another point about these motions is that during the time the crank-pin is going around the arc of pause, the most irregular portion of the stroke is cut off, and in some lines it seems to the writer that this might be worth considering. This is clearly shown in Figs. 3 and 4, in which the motions of Figs. 1 and 2 are plotted.

There will be a tendency for the reciprocating parts to over-travel at the ends of the stroke and continue traveling while the crank-pin travels through the arc of pause. This can be taken care of by buffer springs placed so that they will be compressed slightly before the pause is reached and thus hold the yoke in contact with the roller.

It will not be necessary to go into this motion any further, except to remark that other shapes of the yoke will give some very peculiar motions. The writer put in a little time fooling with a cardboard model, and got some results that were surprising in the way of pauses, accelerated speeds, etc.

It is not claimed that this is original with the writer, and it would not be surprising if some of your subscribers should arise and relate how they saw it when they were cubs; nevertheless, it is certainly not in common use. R. C.

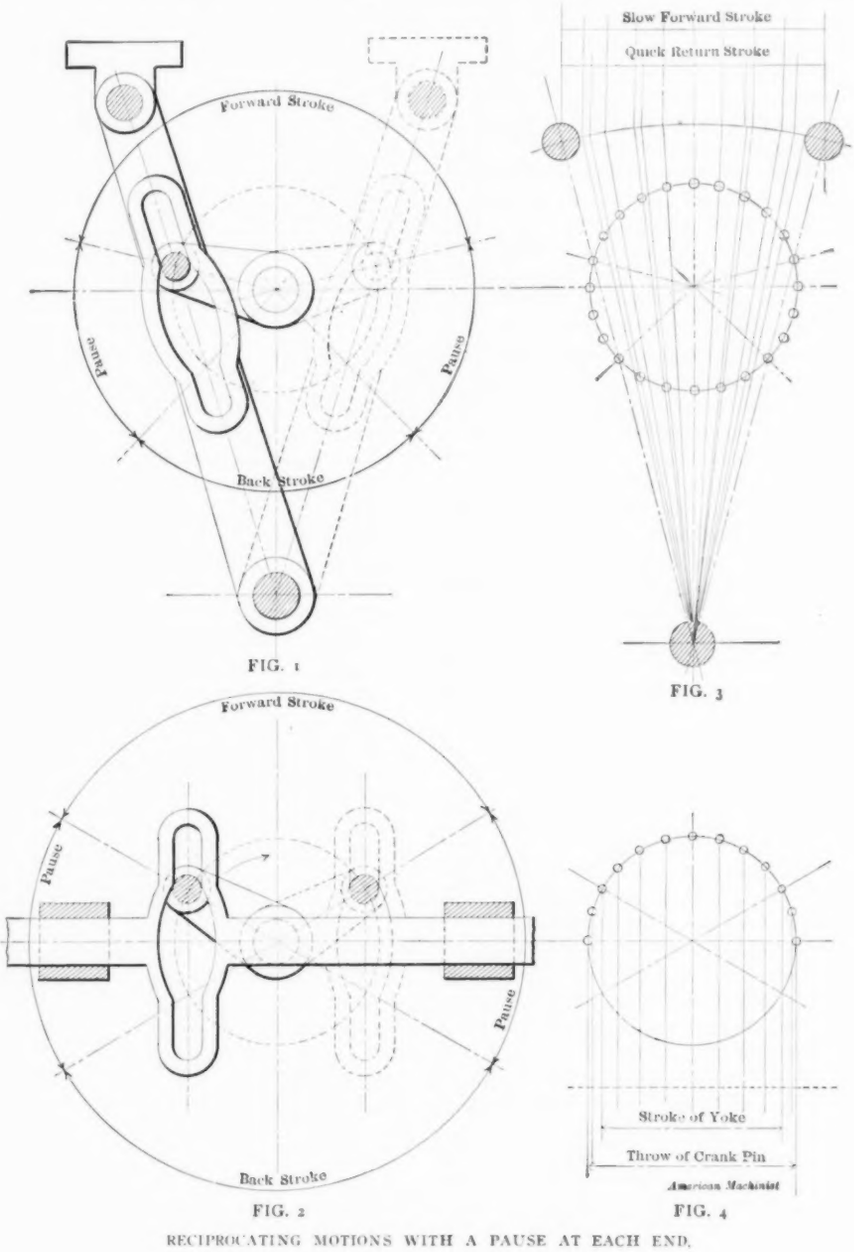


FIG. 1 FIG. 3

FIG. 2 FIG. 4

RECIPROCATING MOTIONS WITH A PAUSE AT EACH END.

Mistakes of Builders in Cutting Gaps in the Edges of Beams.

Editor American Machinist:

While looking over some partially completed houses, built to sell, I noticed an offense which builders of ordinary structures are very commonly guilty of against the rules of good construction. About one-half of the floor joists had gaps cut in their upper edges for the purpose of laying gas pipes, and, as these pipes led to chandeliers in the room below, the cuts occurred about at the center of the length of the joist, precisely the point at which they would weaken it the most. In most of the instances in which this was done it might easily have been avoided by the exercise of a little common sense in the planning and arrangement of the gas piping, and in every case by putting in an extra elbow and a short, straight piece the piping could have been led in so as to lie parallel to the joists in place of across them. Of course this latter plan renders the piping less accessible for repairs, as it is not possible to lay open an entire length of pipe by the removal of a single board from the floor, but this consideration can have but little weight

against the objection to weakening the joists by cutting gaps in their edges. Most men when making such a cut have no idea of the result upon the strength of the joist of what they think is only a "little nick." I once found a workman cutting away the entire flange from one side of an I-beam where an interference occurred through a mistake in the drawing. He supposed that he was doing it but little harm. In fact, he might have cut away freely at the casting which interfered, but this, being an electric motor, was more or less of a mystery to him and he had respect for it accordingly, but to cut a "little bit" out of the beam seemed a very simple thing to do. It necessitated the procuring of a new beam, however. This mistake was not made by an unskilled man, but by one who was supposed to be capable, not only of doing work himself, but also of directing others.

If a cut must be made in a beam for the purpose of passing anything through it, such as gas pipes, electric-light wires, etc., anywhere near the center of its length, it should be done, if possible, by drilling a hole near the center of its depth, as it is here that the material is least effective in resisting bending. If a joist 12 inches deep have a gap 1 inch deep cut in the edge of it, we still have 11-12 of the material left, but the strength is reduced to about 4⅚ of that of the full joist. To have drilled a 1-inch hole in the center of its depth would not have weakened it appreciably. Perhaps an example of another kind will illustrate this more fully: A rectangular beam 24 inches deep by 1½ inches wide will have 36 inches area of section, while one of the same depth but 2 inches wide with a hole 15 inches diameter through the center will have same strength, although the remaining sectional area is only 18 inches, just one-half of that of the first one. Practically anything which weakens or destroys the extreme upper or lower fibers of a beam damages it to a greater extent than is shown by calculation, since nearly all the bending occurs at the weak spot instead of along the entire length of the beam; and especially in the case of wood, where the fibers have been severed the work of destruction has been commenced and will very probably be extended by every vibration to which the structure may be subjected. It is safe to say that a very small gap may be the cause of the total failure of a wooden beam, and there is seldom any necessity for weakening them in this way.

The same principle holds good to a great extent in the case of columns also. They are usually proportioned to resist buckling, and for this the extreme fibers are the most useful. If for any cause material must be removed from the section of a column by cutting or drilling, it should be done, if possible, near the center of the web and as far from the center of the unsupported length of the column as is practicable. The length of a column is always considered to be the distance for which it is unsupported sideways. A long column extending through several stories of a building and held securely at each floor is regarded, not as a single column, but as a number of shorter ones built one above another. The greater the unsupported length the wider and heavier will the column be required for supporting a given load, and the less will be the damage done by drilling a small hole near the center of the section. In the case of very short, heavily-loaded columns, the entire sectional area is generally required for resisting the direct compression, and none of it may be removed without danger of seriously crippling the structure. The probability of buckling a short column being comparatively slight, correspondingly little provision is made against it in designing the section, and only sufficient metal is used to prevent crushing under the load. The short column, then, is considered as a case of direct compression, and every particle of metal in it as being under stress; just as much so as a suspended chain or rod with a load hanging to the end of it, though, of course, the stress is of the opposite character.

In structures composed of rolled-steel sections the necessities of the case sometimes compel the making of connections to the flanges of columns, and, when this is done, particular care should be taken that they be made with rivets, not bolts. The rivets must be driven hard and completely fill the holes in order that they may, as fully as possible, supply the place of the metal that was removed to make room for them. They can generally be arranged so that not more than two of them occur at any given cross-section, and so that the member which they connect adds more to the strength of the column than the rivet holes weaken it. It is often claimed that the rivets in the compression flange of a built-up beam or girder resist the stress as effectively as the metal which they displace, but it is not well to count too surely upon this action, since one or two imperfectly driven or loose rivets occurring at the point of greatest bending moment may vitiate any calculation based upon their assumed perfection, and it is impossible to so inspect the work as to prove that every rivet has been properly driven.

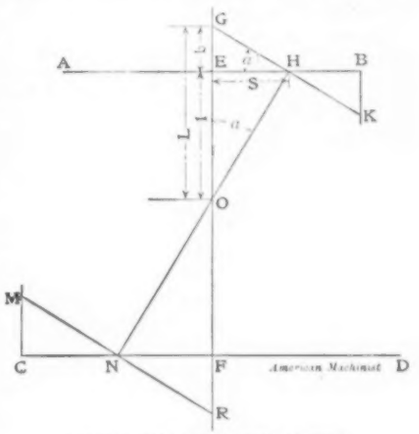
GERALD E. FLANAGAN.

Laying Out Vibrating Levers.

Editor American Machinist:

While studying the motions of vibrating levers and their proper lengths, I have found the following facts which may be both interesting and useful to your readers:

Suppose we have a vibrating lever like the rocker arm of an engine which transmits a reversed motion along two parallel lines, with a given stroke along each line and a given distance apart. Let AB represent the stroke and center line of one motion, CD the stroke and center line of the other, and EF the vertical distance between them. To find the position of the central stud and length of the levers: Lay off $EH = ¼$ stroke AB and $FN = ¼$ stroke CD on opposite sides of EF, and draw HN. The intersection of HN with EF is the center of oscillation. Draw GK at right angles with HN and G and K are the middle and extreme positions



LAYING OUT VIBRATING LEVERS.

of the upper pin. Draw MR at right angles with HN and M and R are the extreme and middle positions for the lower pin. This gives the length GO for the upper arm and RO for the lower.

Solving the problem mathematically:

$$\frac{s}{l} = \text{tan. } \alpha, \text{ and } \frac{b}{s} = \text{tan. } \alpha^1,$$

$$b = \frac{s^2}{l}$$

and $$L = l + \frac{s^2}{l}.$$

Also, $$AB : EO :: CD : FO.$$

This gives a simple formula for computing the length of arms which will give an equal vibration on each side of the central line of motion.

E. O. W.

Grand Rapids, Mich.

The enterprising works manager of one of the largest and most important motor firms in the kingdom, whose works are in the Midlands, being desirous of giving his foremen and hands an opportunity of seeing what was being done by other firms in the trade, organized an excursion to the show. The men were brought to the exhibition by the firm, all expenses were paid, and every opportunity afforded the men of obtaining a most valuable object-lesson. The excursion took place on the last day of the recent exhibition, and the hands were driven to the Agricultural Hall and conducted into the show. Five minutes afterward not a man among them remained in the building. They had all gone to the Crystal Palace to see the match for the English Cup. This may be a tribute to our national love of sport and the fascinations of professional football, but it is a poor lookout for our trade supremacy. If we want to make the best motors it will not do.—*London Daily Mail.*

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Experience With Roller Bearings.

The experiences with roller bearings which we publish in another column remind one of the classical quarrel between two men regarding the color of a shield of which the two sides were of different color and of which each party had seen but one. Each was ready to risk his life in support of the proposition that the shield was of the color which he had seen and in the quarrel both were right and both were wrong.

It is too late to say that roller bearings are an all-around failure, as we know of too many cases in which they have been conspicuously successful. At the same time they are, comparatively speaking, a new thing; knowledge of what they will do and what they will not do is not yet widely diffused and much of it has even to be dug out of experience. The percentage of failures when things are new is necessarily greater than after the conditions of success have been determined by the sifting and comparison of experiences. With roller bearings, like other new devices, this state of things will naturally continue until all ordinary sets of conditions have been tested, but at the same time we have no doubt that many conditions are already sufficiently understood to eliminate uncertainties.

A very striking illustration of increasing success with experience was related to us not long ago by a maker of ball bearings. He stated that not many years ago he simply could not make ball bearings stand up under light buggies unless they also had rubber tires, while he now claims to apply them successfully to heavy trucks.

All this goes to emphasize the importance of a knowledge of the conditions necessary to success, of which the most important are sometimes apparently trivial. We shall welcome further letters upon the subject of roller bearings especially if they throw any light upon the conditions which must be observed if success is to be expected. They are a very live subject just now and information of this kind will be especially timely. With babbitt, brass, iron and all other kinds of bearings we have had to find out by experience what conditions were practicable and what were not; the same thing must be done in the same way with roller bearings and ball bearings, and while the makers of such bearings must know vastly more about the various conditions of their successful working than others can know, even the makers would probably be ready to confess that they have not yet learned all there is to be known about them.

Sale of the Sandy Hook Pneumatic Gun Plant.

It is announced in the daily papers that the plant of three pneumatic dynamite-throwing guns, commonly known as the Zalinski guns, with the air compressors and other auxiliary apparatus at Sandy Hook, have been sold by the government for junk, the price realized being but $20,000—while the cost, including maintenance, has been nearly a million dollars. The reason given for the action is the statement that the guns are out of date and that it is desired to substitute more modern weapons having a much greater range.

It is well-known that the officers of the army have always looked askant at the pneumatic system, the reasons given being its great complexity and consequent vulnerability, with which went also, no doubt a considerable proportion of the excessive conservatism with which army men are endowed. The guns were without doubt a magnificent technical and engineering success. At the time of their official test the writer became somewhat familiar with some of the features and details of the system, and the ability displayed in them can only be described by the word magnificent. With absolutely no precedent for a single feature, the engineers and inventors of this gun developed a weapon which, along with perfection of action in the ordinary use of the term, possessed an accuracy of fire which has, we believe, never been approached by any other piece of ordnance. The limited range in the case of the Sandy Hook guns was of qualified importance, as from the location of the channel no ship of modern size could pass into the lower bay without coming within the easy range of these guns. More than this, at the time of their completion they were the only known means of throwing high explosives from guns. The necessity for avoiding shock when firing was the *raison d'etre* of the entire system, there being at that time no known explosive which could be fired from powder guns without danger of exploding from the shock of the discharge. The complexity of the system and its objectionable character from a military standpoint were patent to all, but whether admissible or not, in view of the results accomplished, is not for a layman to say.

Since the installation of the guns several new high explosives have been invented which are claimed by their inventors to be so insensitive to shock as to be practicable for use in loading shells to be fired from powder guns, and it is known that the army officials have tested many of these at the Sandy Hook proving grounds. What success has attended their efforts is of course not disclosed, but it is to be assumed that the expressed opinion that the pneumatic guns are out of date and the intention to substitute more modern weapons for them can hardly be taken as meaning anything else than that these experiments have been successful and that the throwing of high explosives from powder guns is an accomplished fact.

The sale of the plants at San Francisco and Boston harbors will no doubt follow at once. Thus closes a highly interesting and, in spite of its failure, a highly creditable chapter in American engineering.

An Elevator Accident—A Lesson in Virtual Velocities.

A very unusual accident happened the afternoon of June 30 at the Hanover Bank Building which is in process of erection at Nassau and Pine streets of this city, whereby Michael Manion, a bellman at one of the construction elevators, met with an experience which he will not want to repeat, albeit he suffered only slight injuries. He was on the tenth floor, and as the elevator passed him he was apparently drawn after it by the suction caused by its passing. At any rate, he fell after it and overtook it at the fourth floor, having fallen six stories. His fellow-workmen rushed to the elevator, expecting to find nothing but the mangled remains of a man, but on the contrary they found him in the possession of full consciousness and uninjured except for a cut on his head and a bad shaking up.

For a man to thus fall six stories without serious injury seems at first sight incredible, but it is easily explained. The elevator passed him at a smart velocity, while he began falling from a state of rest. For a time the elevator went faster than he did and the distance between them increased. His velocity, however, kept on increasing, while that of the elevator did not. Presently, he was going as fast as the elevator and then faster, and, with his velocity constantly increasing, he soon overtook the elevator which, in the meantime, had fallen six stories from the point where it passed him. The force with which he struck the elevator was obviously that due to the velocity destroyed by the elevator, that is to the difference in the velocities at the moment he reached it, and it is easy to show roughly what this was, and, calculating back from this, to show the hight of his virtual fall—that is, the hight from which, had he fallen upon a stationary surface, the results as regards injury to himself would have been the same as in the actual case, and the result is rather surprising. For this purpose nothing more than a knowledge of the laws of falling bodies is necessary. There is a source of error in the calculations due to the fact that practically he must have begun falling with the elevator somewhat in advance of him, though just how much cannot be said. Again we do not know the distance "between joints" of the building in question. These facts vitiate exactness in the figures, though they do not affect the principle nor the showing that, virtually, the fall was not a high one.

In these calculations we shall assume that the distance between joints was 12 feet and hence that, as the man fell six stories before overtaking the elevator, his actual fall was 72 feet. We have the well-known formula for the velocity v acquired by a body falling from a hight h:

$$v = \sqrt{2gh}.$$

Substituting 72 for h and 32.2 for g, we have:

$$v = \sqrt{64.4 \times 72}$$
$$= 68.1 \text{ feet per second}$$

as the actual velocity of the man at the moment of impact. The time required for a body to fall this distance is given by the formula:

$$t = \frac{v}{g}$$
$$= \frac{68.1}{32.2}$$
$$= 2.11 \text{ seconds.}$$

Meanwhile the car had fallen the same distance in the same time but at a uniform velocity, which therefore was:

$$v = \frac{72}{2.11}$$
$$= 34.1 \text{ feet per second.}$$

The difference in these velocities or the velocity which was arrested by the elevator platform—that is, the virtual velocity of the fall—was:

$$68.1 - 34.1 = 34 \text{ feet per second.}$$

That is, the violence of the impact was the same as though he had fallen upon a stationary surface from such a hight as would give an actual velocity of 34 feet per second. This hight may be determined by inverting the first formula and then making the proper substitutions. Inverting the formula gives:

$$h = \frac{v^2}{2g}$$

which by substituting gives:

$$h = \frac{(34)^2}{64.4}$$
$$= 17.9 \text{ feet.}$$

That is to say, the fall, measured by its violence, was not from a hight of 72 feet but from 17.9 feet. It would probably be hard to convince the man that he really fell less than 18 feet, and if told so he would probably say that he knows better and with a knowledge that is superior to mere "figgers," but appearances are sometimes deceptive, and this is a case of that kind.

The Doings of Congress.

Just previous to the adjournment of Congress it was agreed to provide for the construction of one of the new naval vessels in a government yard and to permit the Secretary of the Navy to build all of them there instead of by contract if it becomes clear that there is any combination or agreement which prevents open competition among the various builders.

As to the eight-hour bill, which provides that government employees and those engaged in interstate commerce shall all be employed upon an eight-hour basis, the bill was vigorously opposed by a number of manufacturers and the Manufacturers' Association took a stand against it. George H. Barbour, of Detroit, and W. L. Saunders, of New York, appeared before the committee having the bill in charge and made arguments against it. It finally failed because Congress adjourned before it could be brought up. The final effect of the bill is believed to be somewhat problematical. If passed it certainly would mix things somewhat, because Congress has no power to define terms of employment between employers and employees conducting their business wholly within the limits of any State. The State, only, has authority over that if anyone has, and consequently Congress can legislate for only a limited line of employment.

The bill providing for the adoption of the metric system by the government departments also failed to receive consideration, although it almost certainly would have been considered and perhaps voted upon if, as had been expected, Congress had remained in session till the middle of July. Chairman Southard, of the committee having the bill in charge, expressed himself as being greatly encouraged by the action of the American Society of Mechanical Engineers at Boston, which he takes to be a disavowal of the position taken by the members of the committee on this question.

What was known as the anti-injunction or anti-conspiracy bill failed to get through, as did also the bill to create a Department of Commerce with its head as a member of the Cabinet.

The Situation in Worcester.

The collapse of the machine carpenters' strike this week was thought to have had the effect of starting a slump in the machinists' organization, but at present writing the effect is not apparent, though reports are current of straggling machinists in various shops having braved opprobrium attendant upon such action and returned to work. One workman at the shops of Prentice Bros. Company, having decided to accept the company's offer at a certain time and return to work, found his courage somewhat weaker when the day arrived and was constrained to enter by the rear alley and the back door, making complaint that he feared violence from the strikers' pickets. On the strength of this and other overt acts on the part of the strikers, the Prentice Bros. Company on Monday last succeeded in obtaining a temporary injunction from Judge Francis A. Gaskill in the Superior Court, restraining members of the machinists' union from patroling the streets in front of Prentice Bros.' shop and interfering with their employees in any way. Copies of the decree were served on three officers of the machinists' union and on seven members of the lodge. Subpœnas that have been issued are returnable in the Superior Court in August. The effect of this action on the strikers cannot yet be learned, as the balance of the week has been broken up by holidays. O.

Worcester, July 5.

Machinists' Agreement in Pittsburgh.

The International Association of Machinists having made practically the same demands upon Pittsburgh employers that were made in Worcester and elsewhere and those demands having been denied by the employers, several conferences were held between representatives of both sides with the final result that a compromise agreement was arrived at by which the present conditions of employment are to be maintained except that double time is to be paid for work done on Sundays and national holidays; that any disputes that may arise are to be taken up by a committee representing both sides, acting as a joint committee of arbitration, whose decision shall be binding upon both sides, and no stoppage of work can take place during the process of settlement. A 5 per cent. advance in wages is granted and the agreement is to remain in force till July 1, 1903, and longer unless notice of ninety days is given of a desire of either side to abrogate or alter it.

Caution About Steel.

Some suspiciously queer doings are taking place with tool steel, usually claimed to be made by French or other foreign makers. It will be well for our friends to be cautious about buying tool steel for which extravagant claims are made and which is manufactured by firms whose names are unfamiliar. Especially such steel offered by irresponsible parties should not be paid for before trial, no matter how liberal the "discount for cash."

Civil Service Examinations.

The Chief Examiner, State Civil Service Commission, Albany, N. Y., announces competitive examinations to be held at various towns in the State, July 26, for State and county positions, among which are the following: Architectural draftsman, $3 to $5 per day, open to men and women; tracer, office of State Architect, $30 to $40 a month, minimum age 18 years.

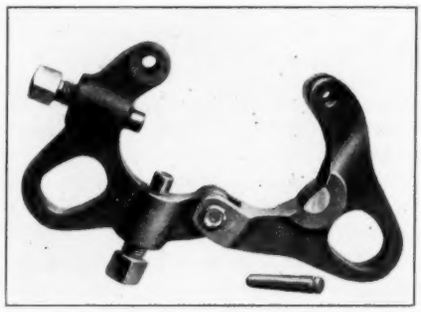
Some New Things.

IMPROVED DIE STOCK.

The Curtis & Curtis Company, of Bridgeport, Conn., has been improving the Forbes die stock. As our readers know, the dies in this stock are carried in a gear ring that meshes with the driving pinion. In the improved stock the shell which forms a bearing for the gear or die ring has been split and provided with a clamping screw. With this arrangement any wear between the shell and gear may be taken up.

LATHE DOG FOR CAR AXLES.

The half-tone shows a dog made especially for center driven car axle lathes. As car axles are smaller in diameter in the middle than at the ends, a solid dog slipped on over the end must be packed up or fitted with long screws. The dog shown swings open and can be slipped over the axle at any point and locked by the taper pin. The two pieces forming the frame or body are steel castings; one piece carries two tool-steel screws, and the other a tool-steel shoe which is free to turn in its seat. The upper face of the shoe is provided with fine teeth, and when the screws are set up, the work is gripped

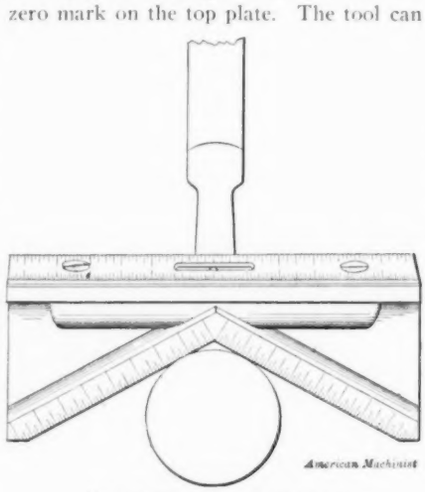


LATHE DOG FOR CAR AXLES.

in the same way that a piece of pipe is gripped in a Stillson wrench. The dog is made by the Shartle Brothers Machine Company, Middletown, Ohio.

NEW SETTING INSTRUMENT.

The cut shows a new machinists' tool recently patented by Morris Chamberlain, of Bartley, N. J. The top plate has a zero line at the center and is graduated each way from this line. When the instrument is level the bubble in the spirit level at the top coincides with zero. The body of the tool is cut out at an angle of 120 degrees and graduated as shown. The apex of the angle is in line with the zero mark on the top plate. The tool can



NEW SETTING INSTRUMENT.

be used for a variety of purposes, such as setting tools for planing keyways in shafting, laying out hexagons, testing twist drills when grinding, etc. The bottom of the legs being planed off flat, the tool can be used on an ordinary level if desired. The cut shows the way it is used when setting a square nose for cutting a keyway in a shaft. The instrument being held level on the shaft, the tool is set with its cutting edge parallel with the graduated plate; by means of the graduations the tool can then be set central with the shaft, or as much to one side as necessary.

Technical Publications.

We have received from the author, Mr. L. R. Pomeroy, an advance copy of his paper read at the recent convention of the American Railway Master Mechanics' Association on "A Typical Shop to Serve a Road or Division Equipped with 310 Locomotives."

The paper discusses the general layout of such a railroad shop and gives the plans of several of those that have been actually built from carefully matured plans, followed by description and plans in considerable detail of such a shop as the author considers best suited to the work. Following this comes a list of suitable tool equipment and a brief discussion of the electrical and power-house outfit, the lavatory and sanitary appointments, costs, organization and methods of compensating labor.

To railroad mechanics the paper will furnish many immediately useful ideas and suggestions and others will find it of general interest.

We notice the statement, which is credited to a Western manufacturer, that "with land at $2,000 per acre, or less than 5 cents per square foot, it is cheaper to use land for one-story buildings than to save land by building more than one story."

"Les Machines-Outils à l'Exposition Universelle de 1900." By Michel Svilokossitch, Ingénieur Civil. Premier Fascicule. Pp., 212, 7½x11 inches. Ills., 128. Also a portfolio of 38 plates 11x14 to 22x28 inches in size. Paris: E. Bernard & Cie., 29 Quai des Grands-Augustins.

We have before us the first volume of a French account of the machine tools shown at Paris in 1900. In this treatise the author has adopted an outline classification as follows: Metal-working machines which depend upon the plasticity of the material; those which operate through removing chips by more or less complicated movements, and those which remove filings or dust. Special consideration is given to screw making and gear cutting, as well as to other special machines. Wood-working machines are also systematically described. The present volume covers hammers, hydraulic presses, bolt forging machines, pneumatic hammers; riveters, pneumatic and otherwise; presses, etc.; punches, shears, cold saws, planers, slotters, shapers and milling machines. The treatment is not purely superficial, neither is it heavy and encumbered with formulas. The different machines are explained with regard to leading features of construction and methods of operation in a running narrative by reference to detail as well as general views accompanying the text. The work, in short, conveys an impression of having been written by

a man who had digested his subject. The plates in the portfolio are fac-similes of drawings and are printed on tough, heavy paper. The financial risk involved in an undertaking of this sort must have been considerable. The author is known to us as a person friendly to American tools, and he shows in this book that he realizes their importance. It may be mentioned that he particularly acknowledges having profited by descriptions published in the AMERICAN MACHINIST.

As an outgrowth of the street-car disturbances in Rhode Island a short while ago, the Supreme Court of that State has decided that the ten-hour law is constitutional and that it applies to conductors and motormen of street railways.

Congress has made an additional appropriation of $75,000 for the buildings of the National Bureau of Standards. The cost of the buildings as now planned is $325,000.

The machinists of the Baltimore & Ohio Railroad system may strike. They object to piece work. The system has been in use in one shop for some time and the company seeks to extend it to other shops. The men demand day work with a minimum wage of 30 cents per hour.

The iron molders of New York and vicinity have secured a nine-hour day by arrangement with the National Foundrymen's Association.

Consul S. Berliner writes from Teneriffe (Canary Islands) that a recent decree of the Minister of Finance establishes an eight-hour day for all workmen employed on the state domains and in government mines and manufactories.

Personal.

Col. Allan C. Bakewell, second vice-president and general manager of the Sprague Electric Company, was recently elected Department Commander at the New York State Encampment of the G. A. R., held at Saratoga Springs.

Commercial Review.

NEW YORK, Monday, July 7.

SUNDRY TRADE NEWS AND COMMENT.

The machine-tool situation from what has been heard of late seems to be running along without material change, a high note here offsetting a low one there. Among the advances in machine tools that have been made outside of those decided upon by numerous makers of lathes and some of drilling machines, have been certain increases by planer manufacturers. There have been quite a number of advances of late among engine and boiler builders.

There appears to be very serious doubt whether the St. Louis Exposition is going to have even tolerable success in attracting foreign exhibitors. At least that is the opinion of a man who has been there observing appearances. At the Chicago fair, while American machinery builders were crowded, there was space to burn among the foreign exhibits; in fact, there was practically no sort of a showing of them at all. Our friend is inclined to think that the St. Louis show is going to fare worse than the Chicago one, but he may not have taken into account just how bad the Chicago was.

The announcement in the advertising columns of the AMERICAN MACHINIST by the German Niles Tool Works Company that it is "ready to buck against a 45 per cent. tariff wall" seems to have excited quite a little attention in the machinery district. It is intimated that this is not the only German concern which has been looking in the same direction. On the basis of prices abroad, the proposition is regarded as not unreasonable. One of the opinions put forth is that the length of time required in transit from Germany would just about equalize deliveries with American ones, though from the scarcity of tools in this country it would seem to us that the German manufacturers might be able to outstrip ours in some cases if they have the machines ready to ship. The question arises: If German machine tools can be sold in the United States, then why not steam engines, why not dynamos and motors? Where we have suggested the possibility to men in these latter lines of trade it has seemed to them unheard of.

The present season, commercially, bears a pretty strong resemblance to 1899. That was the year, it may be remembered, when there was such a great lengthening out of deliveries all along the line and prices went sky high. This year the congestion of producing facilities has not been attended with such delirious symptoms and, as regards machine tools, does not seem to have been as acute, although it would no doubt have been worse had it been complicated with its former proportion of export trade. But the uplift of prices is well illustrated by the radical increases on pig iron. The discouragement of building operations, too, has its old appearance. While not directly pertinent to machinery it is of general interest to note the advanced cost of wooden houses. This has been very forcibly emphasized within our knowledge by the sluggish demand for building lots. Who is going to build when the materials will cost him 30 per cent. more than their normal value?

The strike of the coal miners in West Virginia has seriously affected the trade of Ashland, Ky., and other cities. A large steel mill and rod plant at that point has been forced to shut down through inability to secure coke and supplies in sufficient quantities, and its finished product departments have suspended in part.

Traveling cranes in a tunnel may appear to some a little out of place. Nevertheless bids have been taken on eighteen of them for the New York Rapid Transit Company. It is understood that they are to be hand cranes of some 5 or 10 tons capacity each.

The Mine & Smelter Supply Company, works and office at Denver, Colo., which has lately opened up a branch office at 139 Liberty street, New York, has done so in order to attend to its export trade. The prospects in this line are reported very bright. Much capital seems at the present time to be free for investment in the mining industry and there is a disposition on the part of financiers to develop mining properties in various parts of the world. Some New York men very well known in connection with foreign commercial interests are mentioned by way of illustration. There are believed to be great prospects in the Philippine Islands, as well as in Cuba and South America. An order has lately come in for $25,000 or $30,000 worth of equipment for gold-mining purposes in Peru, a machine-shop outfit being included. It is noteworthy that comparatively little stress is laid on South Africa as a market, the opinion being that the English are favored there in placing orders. The Mine & Smelter Supply Company makes a leading specialty of the Durkee Electric rock drill, of which it is sole manufacturer, but handles a great variety of other apparatus for mining and smelting plants. It is agent for the American Expanding Pulley Company, of Denver.

A movement is on foot and a conference has already been held to consolidate the independent shipyards on the Great Lakes where steel vessels are built and repaired. The firms already parties to the conference are the Craig Shipbuilding Company, Toledo; Empire Shipbuilding Company, Buffalo; Columbia Engineering Works, Marine City, Mich.; Burges & Burges, Manitowoc, Wis.; Jenks Shipbuilding Company, Port Huron, and the Shipowners' Dry Dock Company, of Chicago. It is intimated that in case the deal is carried out, the new consolidated company will be taken over by the American Shipbuilding Company, which is itself a consolidation. This arrangement would tend to set a counterweight against the United States Shipbuilding Company. Recently two ocean ships were built at a Cleveland yard, being so large that they had to be taken through the St. Lawrence in sections. They were not brought through, however, without running one of the sections on the rocks, which object lesson will not improve the competitive chances of the lake yards in future work of the larger sort.

The Farrel Foundry & Machine Company, of Ansonia, Conn., has recently been shipping to Porto Rico the machinery for four large sugar mills, the shipments representing an aggregate weight of about 500 tons.

A syndicate of capitalists is stated to

have been formed to buy out the stock, plant, patents and good-will of the American Ferrofix Company. The new company proposes to establish agencies throughout the country, the idea being to have one agent at least in every township, who shall control the sale and the use of the Ferrofix brazing compound in his territory, so that the brazing of cast iron, steel, wrought iron and malleable by this process shall be entirely controlled by one individual in each section. This principle in Europe has been successful, the earnings of the parent company being, we understand, over 200 per cent. on the investments in Germany alone, where important corporations are affiliated with the company.

Hydraulic mining having been prohibited by the National Government in many parts of California, the hydraulic development companies are profitably turning their attention to power and irrigation projects, using the water for electric power purposes before selling it to the farmers. The Central California Electric Company has recently purchased two 1,000-kilowatt Westinghouse alternating-current generators, which will be direct connected to water wheels and used to supply power to Grass Valley, Nevada City, Sacramento and adjacent towns. The Industrial Works, of Bay City, Mich., manufacturer of railroad wrecking cranes, etc., will shortly install additional electrical power apparatus. A recent purchase from the Westinghouse Electric & Manufacturing Company includes a 150-kilowatt direct-current generator, a 200-kilowatt two-phase alternator, and a number of induction motors. The Westinghouse Electric & Manufacturing Company shipped $17,000,000 or $18,000,000 worth of goods during the last fiscal year ending about April. The prospects are that in the present fiscal year the amount will run up to $25,000,000.

E. H. Ludeman, 39 Cortlandt street, steam engines, etc., says that his business for the past half year has been almost equal to his entire trade last year. He is agent for the Fitchburg (Mass.) Steam Engine Company and for the Murray Iron Works, Burlington, Iowa, though the latter agency does not extend quite to the beginning of last year.

Among late orders of the Crocker-Wheeler Company, Ampere, N. J., we note especially the following in engineering lines: To the Standard Steel Works, Burnham, Pa., two 200-kilowatt generators; Buda Foundry & Manufacturing Company, Harvey, Ill., 240-kilowatt generator; Tidewater Steel Company, Chester, Pa., 250-kilowatt generator; Green Engine & Machine Company, Harrison, N. J., four 35 horse-power motors.

STRUGGLE FOR SOUTH AFRICAN TRADE.

The following interesting version of the South African trade outlook is from the London *Daily Mail:*

"The proclamation of peace marks the beginning of what will probably be the most remarkable trade struggle of modern times. For nearly three years the great export houses of Europe and America have been preparing for this coming battle of commerce. . . . In the interior of the new dominions everything will be wanted afresh—from tombstones to cradles, and from bodkins to plows.

"In mining machinery alone there will be an outlay within five years of probably £30,000,000 ($145,990,000). On the rebuilt farms and in the new cities fully 100,000 homes will have to be remade within a year. . . . Agricultural machinery in particular will be in keen demand. There is certain to be a rapid increase in light railways throughout the Transvaal, making a good market for railroad material of all kinds.

"Where will these orders go? In the case of mining machinery, competition will be very keen. The De Beers Company, very important factor in the matter, favors America in some ways. Not long since it sent a special representative to New York, who has been making large purchases there. The Albu group, another important section, favors Germany, representing, as they largely do, German interests. Much of their business goes to the Grusonwerk. The Robinson group is generally regarded as inclined to give some orders to America. Then there comes a very important section, headed by the Messrs. Wernher, Beit & Co., and Farrars, which can best be described as militantly British.

"German work is seriously to be reckoned with in South Africa, but not so much so in the most profitable fields as American. The Germans in the past have been noted for cheapness rather than quality, although the standard of their wares is steadily improving. The strength of the Americans in the mining field lies partly in the fact that many American mining engineers occupy high posts on the Rand. They, in more cases than one, turned losing into paying properties by their methods, and not unnaturally they favor the products of their own nation.

"An examination of recent contracts shows the great extent to which Americans have already got a hold in South Africa. In mining drills quite 75 per cent. of the drills used in South Africa are of American make, and one company in Easton, Pa., is making a first shipment of 200 tons of drills this month to East London. . . .

"In mining machinery this country may consider itself fortunate if it maintains its former proportions, and obtains orders for one-fourth of the total. In structural steel, for which there is likely to be a considerable field, America seems likely to win. For railways the greater part of the orders bid fair to go to Belgium and the United States. . . .

"A demand is certain to arise for a preference for British traders in these new British dominions. Such a preference already obtains in Natal, where it is understood that government contracts are to be given only to English firms, and are, as far as possible, to be made of British raw material.

"Up to quite recently it was impossible to get any bulky imports up country, on account of the railways being required for military work. In consequence, large stocks of goods lay at the ports. Much has been done to remedy this during the past few weeks; but the railways will be by no means free for ordinary merchandise for some time yet. Although a very large extension of trade is coming in South Africa there will, for the next year, be many checks to it, and there will be little opening in the new field except for firms with considerable capital and able to give long credits. . . .

"The immediate expectation of peace undoubtedly had a very favorable influence on the home market, an influence which certainly must increase. Many business houses, especially those connected with our export trades, are launching out in fresh expenditure in view of coming prospects, and orders this week have been especially numerous."

CHICAGO MACHINERY MARKET.

Prices of most machine tools advanced in the Chicago market, July 1, from 5 to 10 per cent., the great majority of them 10 per cent. In anticipation of that rise there was quite good buying during the latter days of June, but the rush to take advantage of the situation was not so marked as might have been expected. June trade was generally pronounced excellent in machine tools, probably equaling that of May. July at the start is less active, but the holiday character of the first week may have influenced trade.

The Marshall & Huschart Machinery Company regard trade as very satisfactory—a little better, if anything, than it has been. With the Pratt & Whitney Company, June was about the same as May. There were many small orders placed. The O. L. Packard Machinery Company sold a fairly good-sized lot to the Grand Crossing Tack Company, Chicago, and another to the Goss Printing Press Company, and reports the aggregate volume large. With the Dawson Machinery Company, June did not start in well, but every day brought its quota of small orders, and when the total for the month was reached it was found to be very good. One of the orders was from the McCormick Harvesting Machine Company. McDowell, Stocker & Co. booked a number of nice orders during June, one of the larger being a complete equipment for the Foster Machine Company, 73 Fulton street, Chicago.

Even better than the activity in iron-working machinery seems to be that for wood-working machinery. The American Woodworking Machinery Company says that June was the best month in its experience, exceeding May by about 10 per

cent. A representative of the H. B. Smith Machine Company says that if no more business comes in during July the month's business will be fair, orders during the first three days of the month, one of them being for twelve machines, being unusually numerous.

The railroads continue large buyers of machinery. One of the important inquirers within the past several weeks was the Chicago, St. Paul, Minneapolis & Omaha road. A large number of machines were asked for.

Western sellers of machinery are not anticipating a heavy business this month. There are, however, a number of inquiries in the market and the immediate outlook is for some business. Factories are generally reported to be sold far ahead, and it is necessary usually to order machine tools considerably in advance in order to secure anything like satisfactory deliveries. Whereas large tools were the more difficult to procure some little while ago, it is said by some sellers that it is now just about as troublesome to obtain the smaller machines.

Quotations.

NEW YORK, Monday, July 7.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$21 15 @ $22 65
No. 2 X	20 65 @ 22 15
No. 2 plain	20 65 @ 21 65
Gray forge	20 15 @ 21 15

Alabama Pig, New York delivery:

No. 1 foundry, or soft	22 25 @ 22 75
No. 2 foundry, or soft	21 75 @ 22 25
No. 3 foundry	21 25 @ 21 75
Foundry forge, or No. 4	20 25 @ 20 75

The minimum prices above quoted were named on next year deliveries by a leading firm. There are rumors of lower ones from some Southern furnaces.

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93 @ 2.10c. in carload lots. Smaller quantities from store, 2.15c. upward.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel — Base sizes — From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—Base sizes—From store, 2¾c.

Copper—Lake Superior ingot, in the neighborhood of 12¼c., with electrolytic and casting fractionally less.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, about 28½c.

Pig Lead—4⅛c., in 50-ton lots.

Spelter—New York delivery, 5⅛ @ 5¼c.

Antimony—Cookson's, 10 @ 10¼c.; Hallett's, 8 @ 8¼c.

Lard Oil—Prime City, 80½ @ 86c., according to brand and quantity ranging from one barrel up to large lots.

New Catalogs.

James Begg & Co., 9 Dey street, New York. Engines and boilers. Folder.

Northern Engineering Company, Detroit, Mich. Cranes. 6x9, pp. 47, paper.

Canadian General Electric Company, Toronto, Ont. Motors. Bulletin No. 826.

James Clark, Jr. & Co., Louisville, Ky. Electrically driven tools. 6x9, pp. 35, paper.

Pickering Governor Company, Portland, Conn. Governors. 3½x6, pp. 11, paper.

The Hendey Machine Company, Torrington, Conn. Milling machines, 6x9, pp. 16, paper.

Estep & Dolan, Sandwich, Ill. Eye and angle bending machines. 3½x6½, pp. 12, paper.

Herron & Bury Manufacturing Company, Erie, Pa. Air compressors. 6x9, pp. 12, paper.

Morse Chain Company, Trumansburg, N. Y. Silent running high speed chains. 6x9, pp. 19, paper.

R. M. Russell, Binghamton, N. Y. Photographs of Russell grinders in album form. Cloth.

The Hamilton Machine Tool Company, Hamilton, Ohio. New "Hamilton" lathes. Folder.

Pratt & Whitney Company, Hartford, Conn. New toolmakers' engine lathe. Pamphlet, pp. 10.

New Corporations.

The Victor Engine & Motor Carriage Co., San Francisco. Incorporators: G. E. Hoyt, C. F. Thompson, *et al.*

Porter Metal Works, San Francisco, Cal.; capital, $50,000. Incorporators: G. Porter, R. H. Gay, E. Sadley, *et al.*

The Washington Milling & Lumber Co. Incorporated, with capital $100,000, to construct a mill in South Seattle, Wash., for the manufacture of flooring and moldings. G. E. Blackburne is president.

The Globe Light & Power Co. Incorporated by J. R. Curnow and H. W. McComas, of San Jose, Cal., and other Santa Clara County capitalists, to secure water rights and build a power plant for the generation of electricity in the high Sierras.

Manufacturers.

The Ashland (Ore.) Iron Works will enlarge its plant this year.

The Alexandria (La.) Cotton Mill Company proposes to build a plant.

R. D. Crowder, of Madera, Cal., will move to Modesto and start a planing mill.

The Electric Light Company, Albuquerque, N. M., has decided to remodel the plant.

The Johnson Electric Service Company, Milwaukee, Wis., will erect a factory building.

The Born Steel Range Company, Cleveland, O., will erect an additional building, 500x120 feet.

The Smith Paint & Varnish Company, of Milwaukee, Wis., will build a factory at West Allis.

Perry Okey, superintendent, is making plans for a new municipal electric plant at Columbus, O.

A new foundry is under construction at the works of the Baldwin Iron & Steel Company, Ottawa, Ont.

The Standard Tool Company, Cleveland, O., has applied for a permit to construct a factory building.

Turney & Martin will erect a shingle mill at Southbend, Wash., with capacity of 120,000 shingles daily.

The East Fork Shingle & Manufacturing Company will construct a sawmill at Vernonia, Ore., this fall.

Plans are being matured for the construction of a new factory by the Knoxville (Tenn.) Knitting Mills.

It is proposed to increase the municipal electric lighting plant at Jacksonville, Fla. A steam turbine is favored.

The E. Ingraham Company, manufacturer of clocks, Bristol, Conn., has broken ground for a new enameling shop.

The Keystone Valve Company, Pittsburgh, Pa., has been granted a permit for a brick machine shop and foundry.

Thos. Clark, A. Struve, Bielfeldt & Wilke and Stade Bros. intend to start a brick and tile factory at Beecher, Ill.

B. A. Porter and I. N. Smith, of Lewiston, Idaho, will build a sawmill three miles from town; estimated cost, $200,000.

The Avino Mining Company, of Durango, Mex., will shortly expend $250,000 on its plant. C. B. Flynn is president.

The Salinas Planing Mill, Salinas, Cal., owned by the F. A. Hihn Company, of Santa Cruz, has been destroyed by fire.

Secretary Bowen, of the Manufacturers' Club, Buffalo, N. Y., is in touch with a project for a 30-ton-a-day paper mill.

The Lorraine Manufacturing Company, of Pawtucket, R. I., contemplates additions to its machine shop and carding room.

T. W. Cliburn, of Los Angeles, Cal., and S. Sorenson, of Whittier, are arranging to build a new sawmill 5 miles south of Julian.

The building contract has been awarded for the reconstruction of the plant of the Vulcan Iron Works Company, Toledo, O.

A four-story factory building, 510 feet long, will be erected at Nashville, Tenn., for the National Casket Company, Oneida, N. Y.

Another election will be called at Weiser, Idaho, to vote on a $40,000 bonding proposition for an electric light and water plant.

The plant of the Mystic Manufacturing Company, manufacturer of worsted suitings, etc., Mystic, Conn., is soon to be enlarged.

The William L. Gilbert Clock Company, of Winsted, Conn., has awarded the contract for the erection of a brick addition, 36x260 feet.

The Stanley Instrument Company, manufacturer of electrical apparatus, Great Barrington, Mass., is about to build a $40,000 addition.

Miller & Schweitzer have laid the foundation for a machine shop at Azusa, Cal., where the Miller orange crusher and the Schweitzer gas machine will be made.

The Northern California Power Company has decided to put in another light and power plant on Cow Creek, 12 miles east of Redding; estimated cost, $200,000.

It is reported from Portland, Ore., that President E. E. Lytle, of the Columbia Southern Railroad, is arranging to introduce oil for locomotive fuel on his road.

The Cream City Woven Wire Works, Milwaukee, Wis., have taken out a permit to erect a factory building, 152x131 feet, four stories, and a boiler-house, 52x45 feet.

Gilbert Booth & Son, Pittsfield, Mass., are about to erect a building in which some machinery will be installed for the manufacture of metal cornices and corrugated iron eaves pipe.

Waterbury, Conn., capitalists are organizing a corporation for the manufacture of brass wire, and the factory of F. C. Slade & Co., in the outskirts of Waterbury, has been leased.

A. Sharboro, 518 Montgomery street, San Francisco, Cal., has completed preliminary arrangements for construction of the electric light and power plant for northern Sonoma County.

The Wichita Planing Mill, Wichita, Kan., has been sold to the Crescent Sash & Door Company. V. E. Appleby will be acting manager. New buildings will be erected and equipped.

Bristol, Va., is to have a barytes mill and paint factory, the buildings and machinery for which will cost about $30,000. The plant will be established by John T. Williams, of New York.

The California Portland Cement Company, of Los Angeles, Cal., will expend $100,000 in improving its plant at Colton. An 800 horse-power engine and more powerful dynamos will be put in.

The Webster & Perks Tool Company, Springfield, O., has purchased land for a new factory which is to be erected at a cost of $10,000. It is the intention to have the building completed by fall.

The Leetonia Tool Company, Leetonia, O., may locate in Sebring and erect a building, 50x100 feet, with a wing 40x50 feet, to manufacture miners' tools and give employment to about fifty skilled mechanics.

The Arizona Power Company is making preliminary surveys of Fossil Creek, Yavapai County, in connection with the installation of an electric lighting plant of 2,000 horse-power to supply the mining camp.

Shurly & Dietrich, manufacturers of saws and brass and iron bedsteads, Galt, Ont., have lost their Maple Leaf Saw Works by fire; loss, including stock, estimated at $75,000. The bedstead factory was saved.

C. B. Coles & Sons Lumber Company, Camden, N. J., is buying new equipment, including box machinery, dryer, etc. A 200 horse-power engine has already been ordered from the Hooven, Owens & Rentschler Company.

A wire glass (glass with a network of wire inserted) factory is to be built at Morgantown, W. Va. The buyers of the site are represented by J. R. Taylor, of Pittsburgh, who says that the Mellons are back of the factory.

The plant of the Capewell Horse Nail Company, Hartford, Conn., except the office, storeroom, boiler-room and annealing shop, has been destroyed by fire. The estimated value of the plant was between $300,000 and $400,000.

L. J. Hanchett, Jr., of San Francisco, Cal., is at the head of an enterprise to put in an electrical power plant in White Mountain, 60 miles west of Tonopah, Nev. The company intends to deliver electric power for the mine and mills in Tonopah.

Plans have been filed for a two-story power house to be built for the Union Railway Company (the Huckleberry Road) on the east side of Southern Boulevard, south of One Hundred and Seventy-fifth street, New York. The building is to cost $20,000.

A plant to cost $300,000, for the manufacture and repair of locomotives and freight cars, will be established by a company of Seattle, Wash., men, headed by E. C. Hawkins. The company will be known as the Etna Locomotive & Machine Company.

Representatives of Charles M. Schwab, the steel king; James Brady, of Albany, and Max Fleischmann, the yeast magnate, have been looking for a site upon which to erect a factory for the manufacture of a new automobile patented by C. J. Dorticus, of New York. It is understood that Newton, N. J., has been considered.

The works of the Ottawa & Hull Power Company in Hull, Canada, which have been in progress for the past eighteen months, are expected to be completed in three months. The company will be in a position to furnish consumers 12,500 horse-power of the electrical energy, but it is probable that it will eventually develop much more.

Plans are being prepared for a plant in Irwin, Pa., for the Hockensmith Wheel & Mine Car Company. The company was chartered recently. The cost of the new buildings is estimated at about $75,000. The demand for mine cars is so great that the Pittsburg Coal Company, though operating its own car works, is in the market for equipment of this kind.

It is reported from Bozeman, Mont., that a new light and power company has been organized by Geo. C. Dier, E. M. Ferris, *et al*, and has filed on 5,500 inches of water on Hell Roaring Creek. The company proposes to build a big plant at the mouth of the creek and transmit power to Bozeman and Belgrade; will also build an electric road from Bozeman to Sailsville.

Machinery has arrived for the factory of the Diamond Automobile Company, Wilmington, Del. The company will manufacture automobiles and power tricycles. The company has elected the following directors: James Baily, C. B. Harris and John H. Parsons, of Wilmington; Charles Burton, of Philadelphia; W. F. Pierce, of St. Paul, Minn., and Martin Mainogue, of Springfield, Ohio.

The Diamond Drill & Machine Company, of Birdsboro, Pa., whose foundry was recently destroyed by fire, state their ability to fill all orders with little delay, and are entering new orders for early filling. They are rapidly starting a foundry in the buildings just completed for their steel casting plant, and will make gray iron castings in these until a new building can be erected for their iron foundry.

The Champion Rivet Company, Cleveland, O., is preparing plans for an additional plant which may be located at Parnassus, Pa., and include a main building, 70x350 feet, machine shop, power-house, pickling house and storage rooms. Bolts also may be made at Parnassus. Owing to the heavy demand for structural material, work on the plant will not be started till next spring.

It is announced that the Howland mills of the New England Cotton Yarn Company, New Bedford, Mass., are to be, or have been transferred to a new company incorporated under the name of the Gosnold Mills Company, with a capital of $1,100,000. It is proposed to equip the Howland plant with up-to-date cloth-producing machinery. The Gosnold Company is controlled by the New England.

Kansas City, Mo., news is to the effect that a cotton mill with 500,000 spindles and 12,000 looms is to be built within 20 miles of Kansas City. Ten million dollars is to be invested, $3,100,000 of which has already been subscribed by Eastern and Western men. W. B. Smith Whaley, of Boston, president of the Olympia and Granby cotton mills of Columbus, S. C., is to be president and general manager of the enterprise.

The Dayton Pattern & Model Works (W. S. Hawker, proprietor), of Dayton, Ohio, are erecting a new five-story brick building, 40x100 feet, to accommodate their rapidly increasing business in patterns and models and pattern supplies of every description. They are in the market for shafting, hangers and belting and some new machinery, including a dynamo for lighting purposes. They want also an outfit for producing gas from crude petroleum.

According to rumor, the Union Steel Company, of Pittsburgh, Pa., is building a steel plant and will spend $10,000,000 to complete the works. Current gossip has it that the company will employ 10,000 men. The Union Steel Company was incorporated under the laws of Pennsylvania in 1899 to erect and operate a steel plant at Donora, Pa. The company contracted for a large rod, wire and nail plant, which was put in operation early in June, 1901.

The American Knit Goods Manufacturing Company, recently chartered in New York State, has acquired control of the plant of Baron, Straus & Co., Brooklyn, N. Y., and it owns also the Brooklyn Knitting Company. The new company is about to build a seven-story mill to cost $125,000. Considerable new machinery has already been contracted for and Theo. S. Baron, vice-president and general manager, sails for Europe July 15, to make purchases. Samuel Baron is president.

The Norfolk & Hampton Roads Shipbuilding & Dry Dock Company will meet at Norfolk, Va., July 6 for the purpose of organization. C. W. Tebault is the chief promoter, and among the members of the company are D. Lowenberg, a capitalist of Norfolk; ex-Governor Atkinson, of West Virginia, and Secretary of State Peter Silman, also of West Virginia. The company is to be capitalized at $10,000,000 and has secured options on property on Hampton Roads to be used for a plant.

Chippewa Falls, Wis., with eight other cities, has closed contracts with the Wisconsin Sugar Company, by which the company agrees to build in each a beet sugar factory, provided the farmers agree to plant 4,000 acres of beets for three years and there is no reduction in the present sugar tariff. Two of these factories are to be erected next year and the others in the following year. The cities named are Chippewa Falls, Watertown, Kaukauna, Beaver Dam, Green Bay, Oconto, Racine, Janesville and Dorchester.

It is reported from Alameda, Cal., that John Dickie & Co., who have the contract for the two new ferryboats for the Oakland Transit Company, will, in connection with the United Engineering Company, build a machine shop and blacksmith shop on the estuary. A force of carpenters has already begun work on the lumber mill to be erected in connection with the same proposition. The Alaska Packers' Association, San Francisco, will also build a lumber mill adjoining the United Engineering Company's plant.

We have received from Riverside, Cal., the following letter: "The Riverside Power Company has constructed about a mile of its canal; the power is all sold to the city of Riverside for 31 years. We have not the slightest idea of sending the power to Covina or to any other town. There is another scheme somewhat lower on the Santa Ana, which was projected to furnish the town of Corona and other places with power. You have my name spelt wrong and the initials wrong also. Yours faithfully, Riverside Power Company, W. E. Pedley, Secretary."

The partnership existing between Joseph H. Ferodowill and D. H. Graves, under the firm name of Joseph H. Ferodowill & Co., of St. Paul, Minn., in the manufacture and sale of motor cycle parts, has been dissolved by mutual consent. The manufacture and sale of motor cycle parts will be conducted by D. H. Graves in his own name, and he assumes the firm's debts and obligations. This copartnership dissolution has no connection with the bicycle manufacturing and repair business heretofore conducted and to be conducted by Joseph H. Ferodowill at No. 86 West Seventh street, St. Paul.

At Quebec it is stated that should nothing unforeseen occur, Sir Chas. Ross will commence the construction of his small arms factory on the Cove fields at the beginning of August, and that the main structure, with floor dimensions of about an acre, will be com-

pleted and ready to begin operations some six months later. Sir Charles Ross is now on his way to England and will not return to Canada until the fall, but is represented by Messrs Ross and Holgate, of Toronto and Montreal, who are the engineers in charge of the work during his absence.

At a meeting of the directors of the Hendey Machine Company, of Torrington, Conn., it was decided to build an addition to the works at once and a contract has been entered into for its erection. This will be an extension on the present brick buildings, 63x130 feet, three stories high, with a tower 25 feet square, five stories, as on the present buildings. It is expected to have this ready for occupancy November 1. The Hendey Machine Company now employs upwards of 450 men, and when the machinery shall have been placed in the new building it is likely that this number will be added to considerably.

The American Railway Switch Company, with a paid-up capital of $500,000, is about to locate near Buffalo, N. Y. Over six acres of land has been secured near Depew for a site for a manufactory. Work of building will begin shortly. It is backed by some of the best known financiers and business men of Hartford, Boston and New York city. Its president is George A. Ricker, of Buffalo. Besides a variety of other work of kindred nature the new corporation will take up as a specialty the manufacture of a new automatic street railway switch, which may be operated by the motorman without leaving or to any extent reducing the speed of his car.

It is reported that another $3,000,000 steel corporation will soon commence operation in the Pittsburgh district, under the name of the New Process Casting & Mining Company. John H. Kendin, a young man employed in the Homestead steel works as distributor of steel, is the originator of the "new process," and is is said that he has the heads of several departments in the Homestead steel works interested with him, and that his process is being tried there. It is proposed to erect a blast furnace with a capacity of 500 tons a day. There will be three foundries—one for machine moldings and small castings, one for forge blooms, rolls and rolling-mill machinery, and one for parts of locomotives, electrical machinery and ship castings. There will be a forge shop, where forgings from the largest to the smallest will be made.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant : see p. 18.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Light machine & experimental work; models made. S. Messerer, 15 Springf. av., Newark, N.J.

Will sell patented machinists' instrument of unusual merit. Morris Chamberlain, Bartley, N. J.

Fine and special machinery and experimental work guaranteed. Wyland Mfg. Co., Williamsport, Pa.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, cut light gears, cams and duplicate small machine parts, in quantities.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

For Sale, on account of death—Hardware manufacturing plant, making staple article; good, steady trade and orders on hand; best opportunity for machinist; price $1,500. "Executor," care AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Experienced mechanical draftsman wants position. Box 637, AMERICAN MACHINIST.

Draftsman wishes to do spare-time tracing at home. Box 653, AMERICAN MACHINIST.

Machine shop foreman at liberty; first-class references; good executive ability. Box 642, AMERICAN MACHINIST.

Graduate mechanical draftsman desires position as assistant; New York city preferred. Box 646, AMERICAN MACHINIST.

Designing draftsman, 10 years' shop and office experience on steam engines, turbines and paper machinery, wants position. Box 636, AMERICAN MACHINIST.

Technical graduate with 6 months' drafting-room experience, desires position as draftsman; engine work preferred. Box 651, AMERICAN MACHINIST.

Tool designer wants position; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

Wanted—Position as machine shop foreman or assistant superintendent; 20 years' experience (8 years foreman); engine work preferred; reference. Address Box 645, AM. M.

Draftsman and designer, capable of engineering and superintending, large experience on automatic machinery and tools, age 31, graduate, references, wants to change. Box 600, AMERICAN MACHINIST.

Situation wanted by a reliable and competent foreman with a broad-minded concern that wants more and better work turned out of their machine shop; $30 per week wanted. Box 650, AMERICAN MACHINIST.

$2,000 factory manager, practical and technical, open November 1; interchangeable parts a specialty; automobiles, gasoline and steam engines, dynamos, electrical parts. Address M. L., care AMERICAN MACHINIST.

A gentleman with years of experience as a works manager is desirous of securing a position with some pushing manufacturing company where ability and practicability are needed and will be appreciated. Address Box 633, AMERICAN MACHINIST.

A man capable of successfully managing a manufacturing plant on modern lines in general machinery, or gas engines, will be open for engagement soon; he thinks he has the necessary qualifications and is ready to demonstrate it. Address A. B. C., care A. M.

A widely experienced superintendent and manager of machine works, expert in best shop practice and construction, of reliable executive ability and high-class references, seeks position with progressive and broad-minded concern. Address Y., 635 W. 61st st., Chicago.

As superintendent of manufacturing concern, an M. E. graduate with 10 years' varied practical experience as designer, chief draftsman, master mechanic, etc.; experienced in producing tools, jigs and special machinery for economical manufacturing; a systematizer and inventor; young and energetic; salary $2,000. Box 648, AMER. MACHINIST.

Designing and constructing engineer, experience covering hoisting, mining and ventilating machinery, blowing, mill and heaviest types of generator engines, costs, specifications, contracts, will be available September 1 for position as manager, general superintendent or similar trust requiring executive ability and business energy. Address Box 649, AMERICAN MACHINIST.

Help Wanted.

Wanted—A machine tool salesman to carry a side line. Box 654, AMER. MACHINIST.

Wanted—A competent mechanical draftsman; one familiar with engine work preferred. Box 644, AMERICAN MACHINIST.

First-class machine tool designer; a position to take charge is open to the right man. Address Box 606, AMERICAN MACHINIST.

Foreman in brass foundry, posted in plumbers' and engineers' goods; state experience and salary expected. Box 652, AM. MACH.

Wanted—A first-class draftsman who is familiar with high-speed engine design; works, Trenton, N. J. Box 610, AMER. MACHINIST.

Wanted—Good mechanical draftsman; one familiar with automobile work preferred; only first-class man need apply. "Y.," AM. M.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—A number of first-class pattern-makers at once; best wages paid. The Baikwill Pattern Works, 970 Hamilton st., Cleveland, O.

Wanted—A good modern machine tool designer, accustomed to extra heavy work. Apply, stating where employed, to Box 607, AMERICAN MACHINIST.

Ha! Ha! Only 40c. (stamps taken) for that 65c. hardened 6-inch rule; have a few left; write quick. E. H. Randall, 235 Wood ave., Springfield, Ohio.

Wanted—By large electrical manufacturing company, first-class toolroom foreman; must have wide experience and ability. Box 647, AMERICAN MACHINIST.

Wanted—First-class draftsman and designer familiar with steam engineering and hydraulic work; steady employment. Address "Blind," care AMERICAN MACHINIST.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—First-class machinery draftsman, thoroughly competent to design new machinery from ideas furnished. Address The American Laundry Machinery Co., Cincinnati, Ohio.

General foreman on high-speed engine building; must be systematic and thoroughly up on modern shop practice; new shop and tools; permanent position with advancement to right man. B. M., care AMERICAN MACHINIST.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—Assistant manager for plant manufacturing automatic engines and similar machines; limited number of men; must be a good manager of men and thoroughly up on handling work systematically and expeditiously. Address G. B., care AMER. MACHINIST.

Wanted—Thoroughly competent foreman on machine tool building, experienced in building pipe threading machinery, familiar with methods of producing duplicate parts on turret lathes; give age, experience, salary expected and references. Box 237, AMER. MACH.

Machinist Wanted.—To keep pace with our rapid growth we need an additional number of experienced machinists; we want steady men of good habits, looking for permanent positions; school, home and health advantages of Madison are unsurpassed; write immediately for particulars; state age, experience, etc. Northern Electrical Mfg. Co., Madison, Wis.

Wanted—Two machine foremen, two bench and erecting foremen, one leading hand on tool and jig work; men wanted accustomed to modern shop methods; line of work, pumping machinery; permanent positions for competent men; state age, experience and wages expected; there are no labor troubles in San Francisco in our line of work. Geo. E. Dow Pumping Engine Co., San Francisco, Cal.

Wanted by a large manufacturing concern in Seattle, Washington, a first-class foreman blacksmith; a young, progressive man preferred; must have wide knowledge of all classes of blacksmith work, light and heavy, and above all he must be a good handler of men, familiar with drawings and of fair education. Address, stating full qualifications, reference and monthly salary expected, P. O. Box 319, Seattle, Washington.

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Abrasive Material Co., Phila., Pa.
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See Roller Bearings.

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Dallett & Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fosdick Mach. Tool Co., Cincinnati, O.
Franklin Mach. Wks., Phila., Pa.
McCabe, J. J., New York.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
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See Grinding.

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Christensen Engineering Co., Milwaukee, Wis.
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Christensen Engr. Co., Milwaukee, Wis.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Iron
Taunton Loco. Mfg. Co., Taunton, Mass.

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Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Newark, N. J.
U. S. Steel Co., Everett, Mass.

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Fay & Scott, Dexter, Me.
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Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Gates Co., Fred P., New London, Conn.
Goodell-Pratt Co., Greenfield, Mass.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankford, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
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The E. Horton & Son Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
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Whiton Mach. Co., D. E., New London, Conn.

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Faneuil Watch Tool Co., Boston, Mass.

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Caldwell, Son & Co., H. W., Chicago, Ill.
Coil Clutch Mfg. Co., New York.
Faneuil Watch Tool Co., Boston, Mass.
Jacobson Mach. Mfg. Co., Warren, Pa.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

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Grant Mfg. & Mach. Co., Bridgeport, Conn.

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Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.

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Brown Hoisting Mach. Co., N. Y. City.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

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Dixon Crucible Co., Jos., Jersey City, N. J.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

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Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Huribut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

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Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Cyclometers
Veeder Mfg. Co., Hartford, Conn.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
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Wold & Co., Torris, Chicago, Ill.

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Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

Drafting Machine
Universal Drafting Mach. Co., Cleveland, O.

Drawing Instruments
Keuffel & Esser Co., New York.

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Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentiss Tool & Supply Co., New York.

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Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Reade Mchry Co., Cleveland, O.

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Cleveland Pneu. Tool Co., Cleveland, Ohio.
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Q. & C. Co., Chicago, Ill.

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Barnes Co., W. F. & John, Rockford, Ill.
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Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
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McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

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Triumph Elec. Co., Cincinnati, O.
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Clark, Jr., & Co., Jas., Louisville, Ky.

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Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Chandler & Taylor Co., Indianapolis, Ind.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engines, Gas and Gasoline
Charter Gas Engine Co., Sterling, Ill.
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Stover Eng. Works, Freeport, Ill.
Struthers, Wells & Co., Warren, Pa.
Weber Gas & Gasoline Eng. Co., Kansas City, Mo.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Exhaust Heads
Burt Mfg. Co., Akron, O.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.

Filler, Oil Can
The Winkley Co., Hartford, Conn.

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Burt Mfg. Co., Akron, O.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
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Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

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Obermayer Co., S., Cincinnati, O.

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Leland & Faulconer Mfg. Co., Detroit, Mich.

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Automatic Mach. Co., Greenfield, Mass.
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Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Hoefer Mfg. Co., Freeport, Ill.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Merrill Bros., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.
Toledo Machine & Tool Co., Toledo, O.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Enginering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Insurance, Boiler
Hartford Steam Boiler Insp. & Ins. Co., Hartford, Conn.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply So., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Wyke & Co., J., E. Boston, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rowbottom Mach. Co., Waterbury, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Molds, Soft Hammer and Vise
Field, Chas. H., Providence, R. I.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Shop
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Cullen, Orlan Clyde, Washington, D. C.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Field, Chas. H., Providence, R. I.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Balkwill Pattern Works, Cleveland, O.
Gobeille Pattern Co., Cleveland, O.
Lorentz & Evarts, Hartford, Ct.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Planers
American Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.

Planers—*Continued*
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Presses, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.
Toledo Mach. & Tool Co., Toledo, Ohio.
Wold & Co., Torris, Chicago, Ill.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Howard Iron Wks., Buffalo, N. Y.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting,
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
Pratt Institute, Brooklyn, N. Y.
Purdue University, Lafayette, Ind.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Chicago House Wrecking Co., Chicago, Ill.
Dawson, John H., Chicago, Ill.
Dustin Co., Chas. E., New York.
Fairbanks Co., New York.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Gump & Co., A. W., Dayton, O.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.
York Mchry. Co., S. M., Cleveland, O.

Separators, Oil
American Tool & Mach. Co., Boston, Mass.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New Haven.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.
Toledo Mach. & Tool Co., Toledo, Ohio.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
Herman Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriache & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
American Tool & Mach. Co., Boston, Mass.
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.
Gray & Prior Mch. Co., Hartford, Conn.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Howard Iron Wks., Buffalo, N. Y.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Prentiss Vise Co., New York.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Prentiss Vise Co., New York.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automobile Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

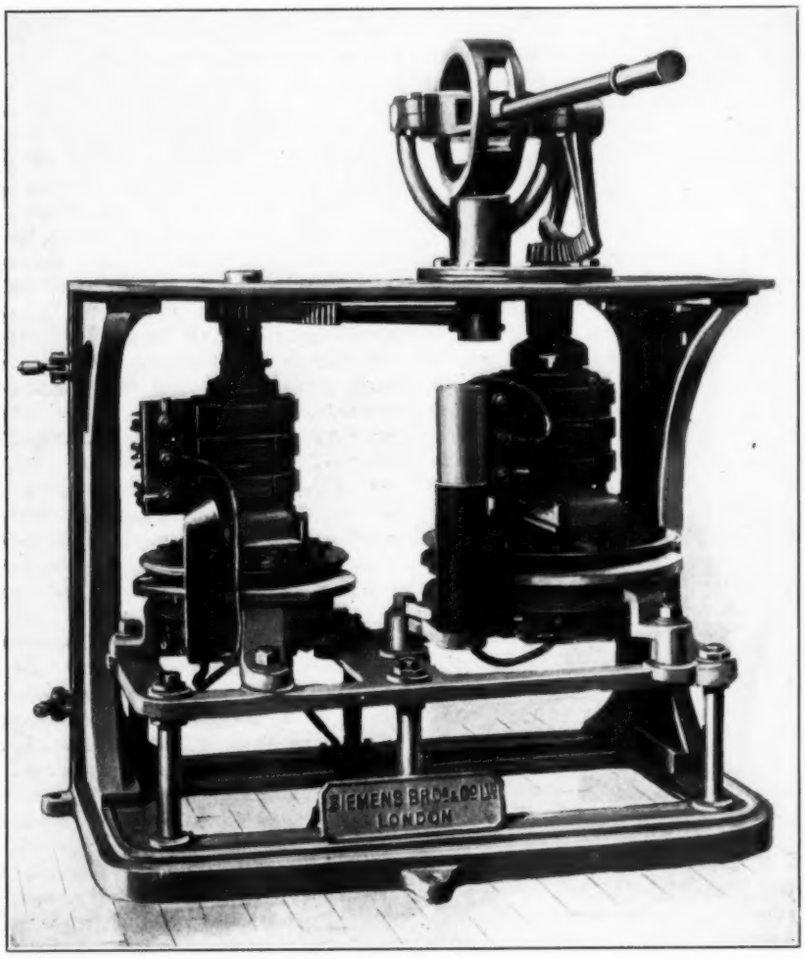
Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Universal Controller for Electric Jib Cranes.

Mr. Frank C. Perkins, of Buffalo, N. Y., sends us the particulars of an extremely interesting and ingenious universal controller which has been applied to several jib cranes which have recently been installed at the Middlesborough docks of the Northwestern Railway of England.

The controller is very clearly shown by the accompanying half-tone. There will be seen to be two controller cylinders, of which the right-hand one controls the hoisting, while the left-hand one controls the slewing motor. The neat feature of the arrangement is that by which both cylinders are operated by a single hand lever. The left-hand cylinder is turned by a spur pinion and segment, the latter being keyed to a vertical shaft extending up through the hub of the yoke and having the slotted ring attached to its upper end. Journals in the arms of the yoke carry a cross-piece which may be swung vertically in these journals and to which the hand lever is so pivoted that it may be swung horizontally. If the lever be swung horizontally it will turn the ring and its vertical shaft, and through them the left-hand cylinder.

The right-hand cylinder is turned by a bevel pinion and segment, which latter is keyed to the cross-piece journaled in the yoke. If the hand lever be swung vertically it will turn the cross-piece in its journals, and through it the bevel segment and right-hand cylinder. These two movements of the handle are entirely independent, each acting on its own cylinder but having no effect on the other. The connections are so made that the vertical movement controls the hoisting while the horizontal movement controls the slewing motor, and, moreover, so that the load follows the motion of the lever, that is lifting the lever hoists, while depressing it lowers the load, and swinging it to the right or left slews the jib in the corresponding direction.



UNIVERSAL ELECTRIC JIB CRANE CONTROLLER.

The Manufacturing of Malleable Iron.

BY JOSEPH V. WOODWORTH.

It was my good fortune, a short time since, to spend some time in one of the largest establishments in the country devoted to the manufacture of malleable-iron machine parts, that of the Walter A. Wood Mowing and Reaping Machine Company, of Hoosick Falls, N. Y., and through the courtesy of Mr. Robert Leith, the superintendent of the department, the material for this article was secured.

The malleable department, exclusive of its sheds, has a floor space of over 163,600 square feet, the foundry measuring 485x 125 feet. In this department, in which 350 men are employed, of whom 135 are molders, there are three furnaces with a capacity of three heats each in a twelve-hour day. The largest furnace, almost at the entrance to the foundry, will melt fourteen tons of metal at each heat, while the other two, in the center of the foundry and at the extreme end, respectively, will each melt ten tons.

The castings produced are mostly of small size and are made from gated patterns. After they have been removed from the molds they are broken from the gates and are sent to the preparing department, where they are sorted, and all lumps, fins and gate joints are removed. The castings as they come from the molds are almost as brittle as glass, and it is possible to split or break them with a light blow of a hammer. It is very interesting to watch the men in this operation. They can take a casting, set the edge or lump to be removed on an iron block and break off at the joint with one blow, leaving the portion where the joint was as smooth as the rest of the casting.

After the castings have been sorted and prepared they go to another department to be packed into the annealing pots. These pots are cast, and are about 24 inches long, 12 inches deep and 12 inches wide, and an inch thick. A mixture consisting of common sand fine steel turnings and steel scale from the rolling mills is then wet with sal-ammoniac (which prevents the steel turnings and scale from adhering to the castings during the annealing process) and packed among the castings in the annealing parts. The pots are now taken to the annealing room. In this room there are eight ovens, the walls of which are three feet thick and the tops and bottoms four feet thick. To build each of these ovens 4,500 red brick and 1,500 white or firebrick were required. In each oven there are flues three feet square, running the full length of the oven and out into the stack at one end. There is also one intermediate flue and a flue at each side into which the crude oil blast is fed.

In each annealing oven pots containing twenty tons of castings are packed as close together as possible, after which the vents and doors are sealed up and the ovens are heated. It requires twenty-four hours of steady blast to get the ovens and castings to a white heat. They are then kept at that temperature for five days and five nights, after which the blasts are turned off and the vents at the tops of the ovens opened. After the vents have been open for five hours the door is pulled down and five hours later the nearest pots are removed, and in the course of a few hours the others are taken out and allowed to cool. They are then dumped and the castings are sorted. All that have cracked or blistered or are warped excessively are

thrown out. The good castings are then sent to the straightening department to be straightened and re-formed, so as to fit the jigs and fixtures which are used for machining those which are required to be machined and to make the others interchangeable. The straightening and reforming of the castings are accomplished by dies in powerful presses. There are seven different machines; one a hydraulic press of seven tons, three power presses of seven tons, one five-ton power press, and two powerful drop hammers. On shelves surrounding the straightening room are hundreds of sets of dies. The dies for the large castings are of grey iron, while those for the small parts are of hard iron. The dies are cast in the department's own foundry by first getting a plaster model of the inside of the master patterns and one of the outside and then casting the dies from these models.

After the straightening and re-forming process the castings are sent to the grinding and finishing department. Here all lumps and fins which were not removed before the annealing are ground off. The parts to be machined are finished in special jigs and fixtures on the drill press, milling machine or lathe, as most suitable, and the castings are then ready for the storeroom.

As every size and style of casting produced in the foundry is numbered, and as the numbers run from 1 to 2,503, some idea may be formed of the storage space required. The patterns used are of composition metal. They are stored in a fireproof vault, 65 by 25 feet and 12 feet high.

To heat the annealing ovens crude petroleum is used; the oil being pumped from three tanks sunk in the ground 300 feet from the ovens and 200 feet from the engine-room in which the pumps are located. One tank holds 13,000 gallons of oil and the other two 6,000 gallons each. The large tank is located beneath the railroad track and is filled from tank cars, and this in turn fills the small ones. The pump used to pump the oil to the annealing ovens runs continually and has not been shut down twelve hours in a year. To melt the iron used in the malleable iron foundry soft coal is used, the furnaces being so constructed as to allow of the coal being placed in the front part and the metal and other materials required to produce hard iron at the back, the heat being driven in on the mixture by air pressure.

Mr. Leith has been with the Wood Company for twenty-five years, and has been responsible for the many innovations in his department tending to economic production, one of which is to use in his foundry all of the scrap steel produced in the main works. He has used 100 pounds of the scrap steel to every ton of iron, and has secured the very best of results by so doing. Formerly it was necessary to sell the scrap steel, for almost nothing in comparison with its cost to the firm, but now the malleable department disposes of all of it. The output from the malleable department per week is usually 150 tons of good castings, the bad work coming from the foundry and annealing department not being counted. The power required for the department is derived from a 150 horse-power engine, which has been in use over twenty-five years, and is to-day a fine example of what care and a good engineer can do for an engine in regard to its longevity.

On the harvesting machinery manufactured by the Wood Company a great deal of chain is used. The links composing these chains are produced in the malleable department and the chains are assembled and finished there. The links are cast from gated patterns, as many as fifty links to each mold. The gating is done in such a manner that when the castings have been broken from the gate bars very little irregularity of surface is evident; what projections remain are ground off after the annealing process. The chains are assembled in continuous lengths by an automatic machine, the links being fed through a chute at the front and the chain fed out automatically at the back. The chains are subjected to various tests to insure their being as required. Often (as the links are not machined before assembling) some of the chains will be shorter than required, this coming about through unequal rapping when molding, etc., the part where the links unite being thicker in some than in others, the accumulation in the course of a number of links making quite a difference in the length of the chain. This defect is overcome by means of another machine in which the chains are stretched until they are of the required length.

There is a metal pattern shop connected with the department in which all the patterns used in the foundry are finished. In this shop some of the finest metal pattern work that I have ever seen is turned out, as is evidenced by the fact that out of a thousand castings of a certain shape only two were found to be "off" enough to prevent their being machined in the fixtures provided for them. Besides producing all the malleable castings which the works require, the department also does custom work, and it has the reputation of having done some of the finest work in the country.

Notes on Crane Design.

Wire rope and chain are both used extensively for hoisting purposes. Chain is used on most cranes employed in the mechanical industries, as well as on steam shovels and dredges. Wire rope is generally used on cranes of high hoist, and for running rigging of various wrecking cranes and derricks, and it has supplanted chain on large dredges.

There is a widespread idea that wire rope requires excessively large sheaves. This is true of standard ropes, but special ropes can be obtained that do not require any larger sheave than the corresponding size of chain.

The advantages and disadvantages of rope can be summed up as follows: It winds closely, giving a high hoist with a short drum. Two or more layers can be wound, although it is not desirable to do so. It is light. Its condition is readily seen and the rope replaced before it gets in a dangerous condition. It cannot be spliced except by an expert, and in places where delay is expensive an extra rope should always be at hand, as one defect may mean a new rope.

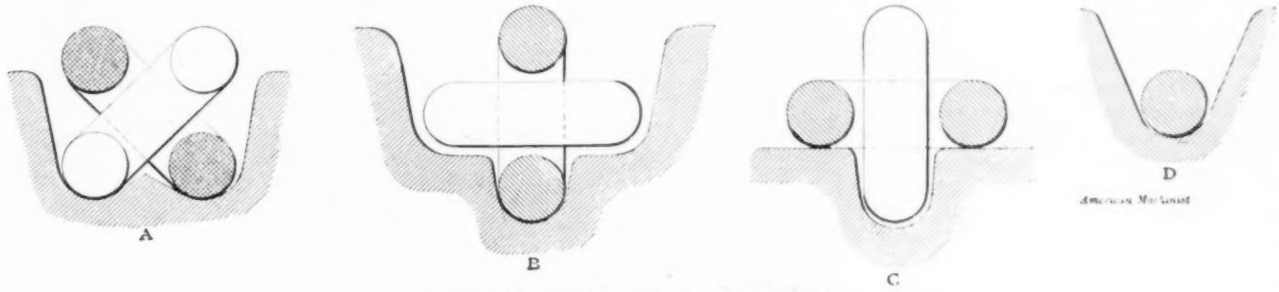
Chain has the following good and bad qualities: It is extremely flexible and can run on small drums and sheaves. It can be used with pocket wheels, no drum being then required. Defective links can be cut out and replaced by a blacksmith. "Cold shuts," or links arranged to be closed and fastened cold can be used in an emergency, till better repairs can be made. It is heavy and takes up considerable room on a drum. Defects are not easily detected, fine cracks all but invisible may suddenly develop into a break. Chain should never wind in two layers. The length of life of either a rope or chain depends altogether on how it is used and how much, a certain amount of care being necessary to insure good results with either. The greasing of chain or rope is just as important as the lubrication of a bearing. Chain should be taken down and annealed from time to time, giving a good chance to thoroughly inspect it. The best way is to have two chains and use them alternately.

There are tables giving the dimensions of links, test and safe loads for short-link crane chains in Kent's Pocket Book. The safe load for crane purposes should be less than given in that table, or about one-third to two-fifths of the proof test. Only the best quality chain should be used. Large sheaves are desirable. Twenty times the diameter of chain is the minimum for drums or running wheel, and thirty times the diameter gives good results. Pocket wheels, shaped to fit the chain, can be made much smaller, as their construction prevents the link from bending.

There are three different shapes of groove commonly used for chain drums. Groove *A* is employed in double drum trolleys where the top block sheaves are at right angle to the drum. This form of trolley gives a spiral hoist that is undesirable for many purposes. This shape gives each link a bearing. Grooves *B* and *C* are used when the drum and sheaves are in line, as in straight hoist machines. The flanges on *B* are intended to prevent the chain from jumping out of the groove, but they are generally more ornamental than useful. Cranes rarely wind in chain faster than 150 feet per minute, and shape *C* does not give any trouble on steam shovels, which work faster and jerk a great deal.

It is largely a matter of individual preference in deciding which shape to employ. Grooves *B* and *C* are laid out in some cases to give a bearing for each link, but sometimes bearing is only given to the flat links.

The outline only of the groove has been shown, as the amount of metal to be put in the rim depends to some extent on the designer. Too much is a waste and too little is bad. The detail dimensions of course depend on the size of chain and clearances allowed. Both steel and iron castings are used. The grooves can be finished most economically by using a formed cutter, but rough castings are sometimes employed, and occasionally chills are used.



FORM OF GROOVES USED IN CRANE DRUMS.

Pocket wheels are often used, generally on hand cranes, but sometimes on power-driven machines. They save a great deal of room, but are subject to all the disadvantages of other wheels of this character caused by wear of wheel and stretching of chain. They are laid out by methods that have been fully described heretofore. The chain should be made to fit the wheel, a casting of which should be sent to the chainmaker for this purpose.

Chains built up of plates and pins, similar to bicycle sprocket chains, have been used abroad for some very heavy cranes. This sort of chain can be made as heavy as desired, but, as it cannot be wound spirally on a drum, special means must be used to care for the slacks. The hoisting is done by a sprocket wheel.

The accompanying table on steel hoisting rope refers to a special eight-strand rope. The information was given by the makers, but is not found in their published list. The safe loads given are suitable for crane work, but in other lines the factor of safety used varies from 6 to 50. The sizes of sheave given, which are very small compared to those used with standard ropes, are the smallest permissible. The larger they are the better for the rope. Rope grooves should always be finished.

Running sheaves are usually brass bushed, and turn on a pin. The bearing area is limited, and they are often located in inaccessible positions. Therefore the means for greasing them should be efficient. General practice is to drive the bush tight in the hub, but loose bushings perforated with oil grooves are also used.

The strains on a crane sheave are those due to the pull of the load, and to its swinging sideways. The resistance to its turning is due to friction alone, and the arms should therefore be strongest at right angles to the groove.

The drums used are usually grooved to suit the chain or rope, but straight-faced drums with end flanges are sometimes employed, though rarely on cranes. The groove for chain is similar to *C*; that for rope is a helix cut with a round-nose tool. A small clearance should be allowed between adjacent wraps. Mr. Charles Lewis gave a method of calculating the strength of drums for hoisting machinery at page 113, Vol. 20.

Diameter of Rope, inches.	Crucible Steel.			Plow Steel.		
	Approximate Breaking Strain in tons of 2000 pounds.	Safe Load in pounds.	Minimum Diameter of Sheave in inches.	Approximate Breaking Strain in tons of 2000 pounds.	Safe Load in pounds.	Minimum Diameter of Sheave in inches.
3/8	3.25	800	4	5.4	1300	5
1/2	7.25	1800	6	9.5	2400	8
5/8	11.60	2900	8	15.2	3500	10
3/4	16.00	4000	12	21.60	5400	15
7/8	21.60	5400	15	28.80	7200	19
1	28.75	7200	18	38.40	9600	23
1 1/8	36.00	9000	24	48.00	12000	30
1 1/4	44.00	11000	28	57.60	14100	35
1 1/2	62.00	15500	32	80.00	20000	40

THE STRENGTH OF STEEL HOISTING ROPE.

Going to Nature.

Among mechanicians a great deal is heard about learning things from nature and many mechanics are fond of tracing analogies between nature's structures or ways and the things done by men. An original view of this matter is taken by an editorial writer in *The Journal*, of New York. Speaking of Professor Langley's experiments in mechanical flight, he says:

On two high towers Professor Langley places his cameras. As the birds pass they are photographed from two positions at once; the direction and force of the wind are recorded at the same time.

Buzzards and other high-soaring birds are studied especially, and Professor Langley thinks the photographs will help him to solve the problem of human flight.

Any kind of concentrated observation is useful. Probably Professor Langley will be led to useful thinking and experimenting by his watching of birds. But he will not learn from birds the secret of human flight. That secret, like all other great secrets affecting humanity, will be found in the human brain.

Nature—so much praised and forever put before us as an example—does things really in a primitive, wasteful way. Her forces work regardless of economy, and puny man, mentally developed only one-thousandth part, can already teach nature more than she can teach him.

Man could not learn the secret of swift locomotion by watching the antelope. He could not solve the problem of transcontinental freight-carrying by photographing the powerful elephant or whale.

He had to use his brain. Through his own genius he learned to take a sphere, cut a slice out of it and make a wheel. Two of these wheels he attached to an axle. He had his cart—a rough concern first. He has now his ball-bearing sulky, and his lightning express train. He will have swifter and more marvelous conveyances later. But they will come out of his *brain*—not from nature. There is no hint in nature of the railroad, nor of any great and indispensable human machine.

Nature carries birds through the air by means of exaggerated fins, acting on the atmosphere as fins of fishes act on water. She sends animals speeding through the forest on four levers, which strike the ground and propel the beasts in various awkward ways. But a little girl on a bicycle could run any deer to death in a forenoon, and in the future that same girl will be able to outfly the condor and make the albatross feel like an aerial stage coach of days gone by.

The one powerful thing in this world is an *idea*. One simple idea made the sewing machine—it could not have been inspired by the "darning-needle" flying over the pond, nor by the Baltimore oriole weaving its nest. One idea will solve the problem of human flight, and all our other problems will be solved similarly, by the one necessary idea.

The Honorable Mr. Archimedes was *thinking* in his bathtub—and the one idea that came to him solved a great world problem. He would have wasted his time had he taken a fish with him into the bathtub and studied that fish.

The great problem of social organization will be solved by the force of one idea—

that of "Industrial Attraction," to which the immortal Fourier gave birth.

The real force on earth is *man*, and not *nature*. Nature received and cared for us at first—in true stepmother fashion. She gave us cold stone caves, cheerless, long-haired mammoths and inhospitable cave bears for food and for neighbors. All the rest we had to do ourselves. We had to change iron ore into swords and guns and kill off the reptiles and other monsters. We had to drain the swamps and cut out the forests that nature lavished in every direction. We have still to water nature's deserts—spots of eczema on the earth's surface. We have ahead of us the perfecting of our own social life, the amelioration and control of climate and rainfall.

All of this work will be done inside of our brains. Watching the buzzard will teach nothing about flying, nor will watching fish teach anything about the perfect ship. As well watch the mole and ask him for hints on building the Mount St. Gothard Tunnel.

In the curious, oily gray mass inside the human head lies the solution of all earth's problems. The force at work in the brain is the agent of Divine Wisdom—able to do whatever it will through hard work. And that is what makes life interesting and worth while.

German Cold Saw Cutting-Off Machines.

The accompanying illustrations show three cold saw cutting-off machines that are part of an interesting line built by Gustav Wagner, Reutlingen, Würtemberg.

The machine shown in Fig. 1 handles stock up to 12x4½ inches. The saw, which is 16 inches in diameter, is mounted on an arbor that is carried in a swivel head secured to the front of the ram. This ram is square in section and travels in a long rigid guide. The head is graduated and can be swung clear around in the vertical plane and clamped in any position, thus making it possible to cut off the stock at any desired angle. The saw arbor has taper bearings, the boxes are of bronze, and the saw can be mounted on either end of the arbor. The arbor is driven by means of a phosphor bronze worm wheel and steel worm, the worm shaft running longitudinally through the ram, and carrying on its end tight and loose driving pulleys and an eccentric for the feed motion.

The feed screw is journaled in a bracket at the end of the ram, and runs through a nut which fits freely in a bracket cast on the top of the ram guide. The screw is rotated by a ratchet wheel and pawl, the latter being carried on an arm operated by the eccentric on the driving shaft. The feed nut has a shoulder resting against the inner end of the bracket. A rack is formed at the top of the nut and meshing

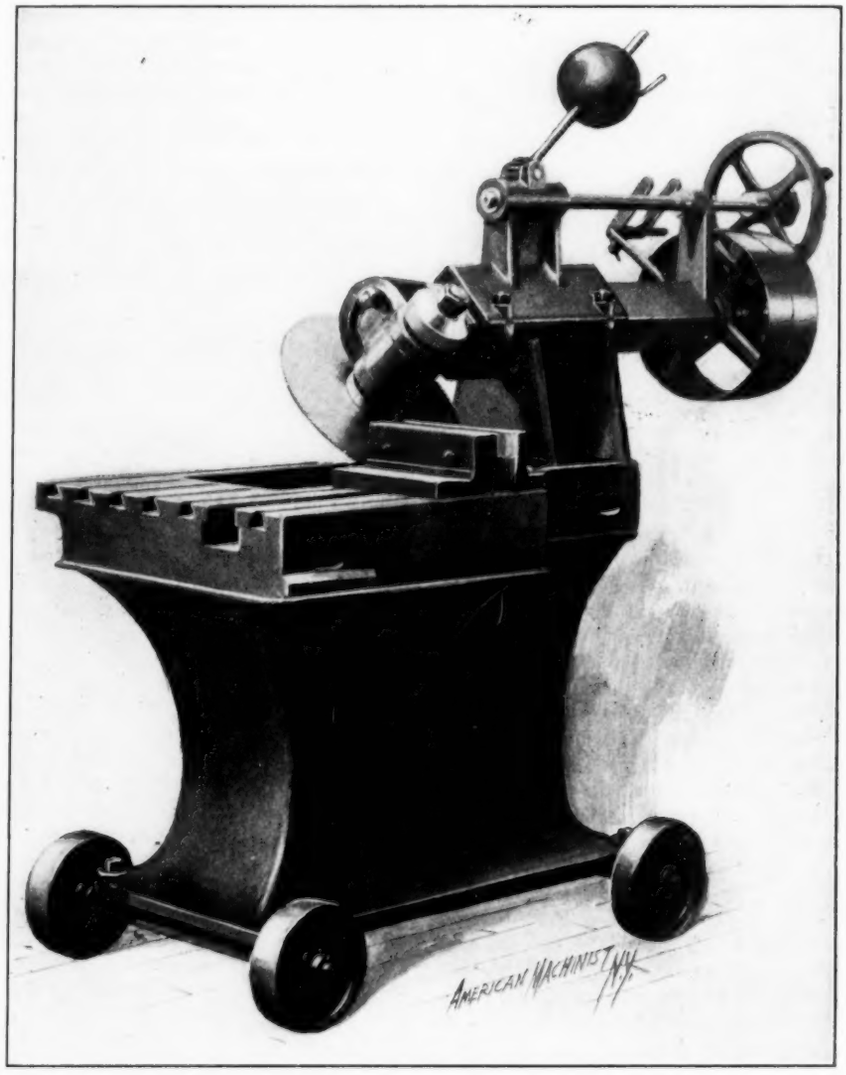


FIG. 1. COLD SAW CUTTING-OFF MACHINE.

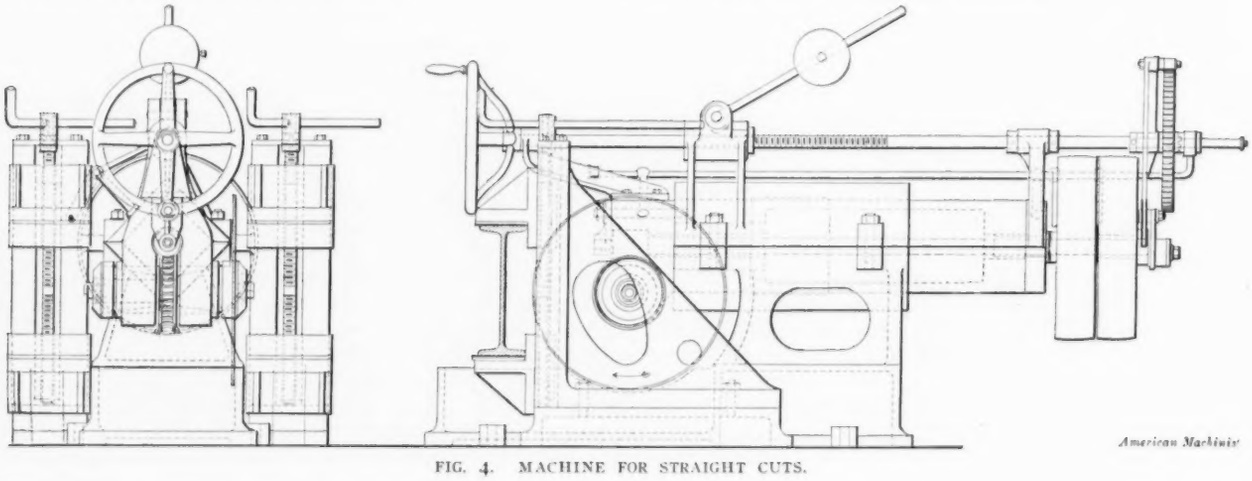


FIG. 4. MACHINE FOR STRAIGHT CUTS.

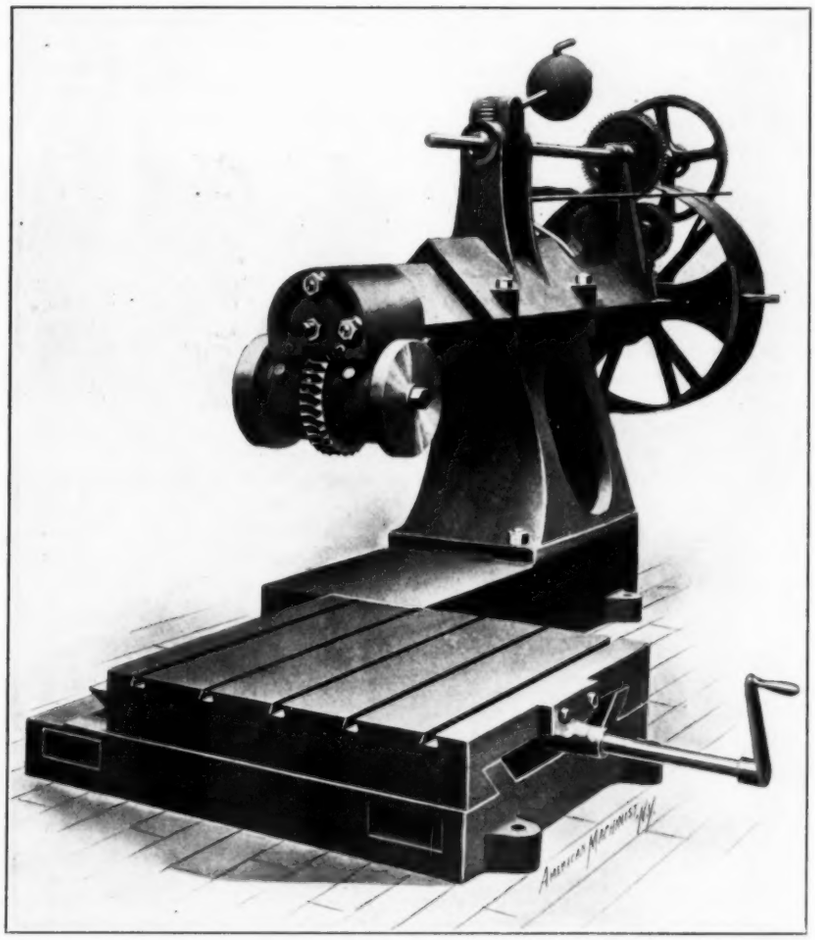


FIG. 2. MACHINE FOR TRIMMING LARGE CASTINGS.

with this rack is a pinion to which is attached an arm carrying an adjustable weight. This arrangement makes a very sensitive feed; it is easily regulated by shifting the weight, and when the saw becomes dull and does not cut freely the weighted arm lifts and prevents the saw breaking.

The machine is fitted with a vise for holding the work, and a pan is formed in the table for soapwater or other lubricant for the saw.

Fig. 2 shows a machine intended for cutting off risers and for trimming up large steel castings and forgings. The saw is not shown; when it is in place it is held to its flange by countersunk screws, allowing it to run up close to the work. The ram, head, driving mechanism and feed are arranged in practically the same manner as in the machine shown in Fig. 1.

The work table is 40x40 inches and is provided with hand feed. The machine is built in two sizes, for saws 23½ and 39½ inches in diameter.

The machine shown in Figs. 3 and 4 is designed for square cuts only. It carries a saw 30 inches in diameter, cuts beams up to 20 inches and round stock up to 10 inches. Both automatic and hand feeds are provided. The vises being open in front there is no danger of breaking the saw when handling heavy beams.

In cutting long beams or heavy shafts to length on this machine, it is not necessary to turn the work around; for the first, or squaring, cut is taken with the work in the right-hand vise, and then the piece is shoved ahead and held in the other vise while the second cut is made, thus saving considerable time and shop room. Both upper and lower jaws in the vises are movable, being operated by right and left hand screws, and the work is always held central with the saw.

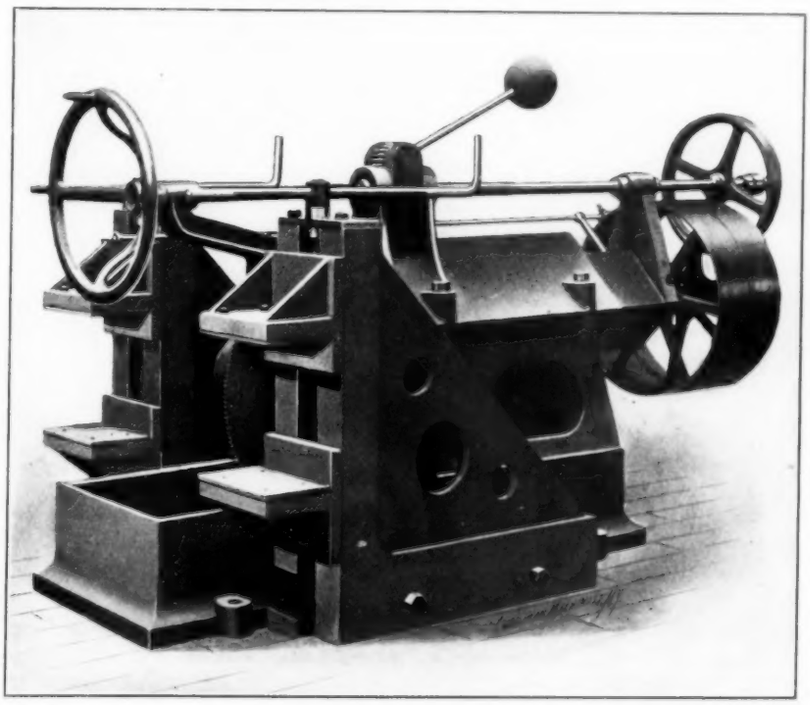


FIG. 3. MACHINE FOR STRAIGHT CUTS.

Curious Steamboat Construction.

We see in print a description of the building of the steamer "Weetamoo," which is to ply on Lake Sunapee, N. H. The hull of the steamer was built in Baltimore, her engines in Boston, and she was launched in New Hampshire. The Baltimore builders of the hull were the Dry Dock Company, and as soon as the hull was completed it was taken apart, the pieces numbered, loaded upon cars and shipped to the place of launching. This is described as "Curious Steamboat Construction." It would not, however, be regarded as curious in Switzerland, where very many of the steamers that ply on the Swiss lakes have been built in just this manner. In fact, the well-known firm of Sulzer Bros. have built many steamers in that way, and when the writer was at their works in 1897 they had at least one such steamer in course of construction. Their practice is to bolt instead of rivet the parts of the hull together just sufficiently to enable them to get the construction correct. The parts are then unbolted and are afterward riveted permanently together at the point of launching on the shore of the lake on which the steamer is to ply.

A Set of Dies for Rectangular Tin Boxes.

BY JOSEPH V. WOODWORTH.

In no branch of modern sheet metal manufacturing have dies and press fixtures been developed with better results

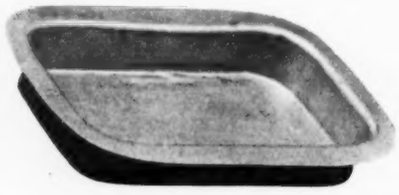


FIG. 1. FIRST OPERATION, BLANKING AND DRAWING.

than in the manufacture of decorated tin boxes of rectangular or irregular shapes. As these have almost completely superseded the old pasteboard and small wooden kinds, the number of skilled and well-paid mechanics constantly engaged in making improved tools for their cheap and rapid production is enormous. It may not be irrelevant to say that in the manufacture of such articles results are attained, both as to cheapness and rapidity of production, which are not equaled in

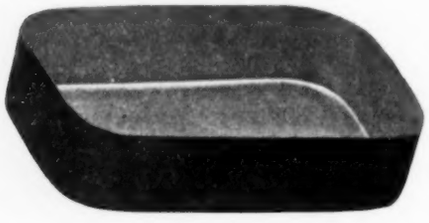


FIG. 2. SECOND OPERATION, TRIMMING AND FINISHING THE DRAW.

any other branch of sheet metal manufacturing.

The following description and accompanying illustrations are of a set of dies for the production of vaseline boxes and covers, the dimensions of which were required to be: 3⅞ inches long by 1 13-16 inches wide by ¾ inch deep. The operations required to finish the box and cover are shown by the half-tones, Figs. 1 to 4. Fig. 1 is the result of the first operation—that of punching out the blank and drawing it as shown. Fig. 2 is the appearance of Fig. 1 after the second operation, which consists of trimming the edges of the blank and drawing it to the hight shown. The third operation consists of forming the narrow bead in the four sides of the box, as shown in Fig. 3. Fig. 4 shows the cover of the box, which is blanked and drawn and paneled in one operation.

FIG. 3. LAST OPERATION, BEADING THE SIDES.

The first operation, Fig. 1, is accomplished with the punch and die shown in vertical cross-section in Fig. 5, Figs. 6 and 7 showing plans of the punch and die respectively. This punch and die are of the single-acting, combination blanking and drawing type. The cutting or blanking die is finished from a forging of mild steel with a tool-steel ring welded on for the die proper. Beneath the blanking die is the punch plate, on which are located the spring barrel stud, the drawing punch and the blanking die, the latter located by a dowel at each end. The drawing punch is located and fastened on the punch plate by two dowels and two screws, as seen in the plan, Fig. 7. The blanking die is finished with three degrees clearance and the blank holder ring is machined to fit it. The cutting die is hardened and drawn to a light straw and the face is sheared so as to have four or five high spots equidistant around the cutting edge. The stripper on the die consists of a piece of sheet stock worked out to a clearance size for the punch, and located at the back of the die on two pieces of tubing *B B* by two cap screws *A A*. This kind of stripper works far better than the usual bent pins, and

VASELINE CAMPHORICE
AN EXQUISITE TOILET ARTICLE
Superior to anything in use
FOR CHAPPED AND ROUGH SKIN, HANDS, LIPS &c
Prepared from pure Vaseline by the
CHESEBROUGH MANUFACTURING COMPANY
CONSOLIDATED
NEW YORK, U.S.A.

FIG. 4. THE COVER.

should be used on all dies of this type. The stop consists of a stud driven into the die base and an adjustable, squared piece of stock let into an inclined hole and located by a set-screw. The six tension pins, the buffer or spring barrel and washers and the shape of the blanking die are shown in Figs. 5 and 7.

Fig. 6 Plan of Punch

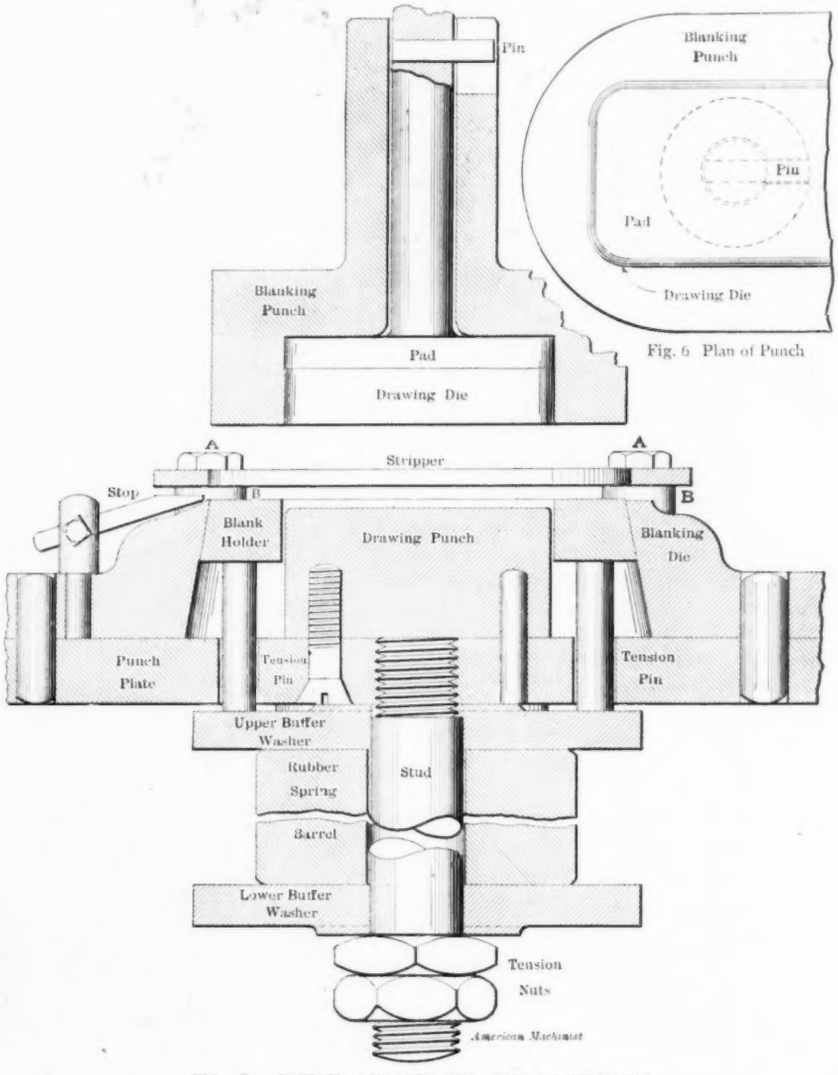


FIG. 5. PUNCH AND DIE FOR FIRST OPERATION.

The punch consists of two parts, the blanking punch, the inside of which acts

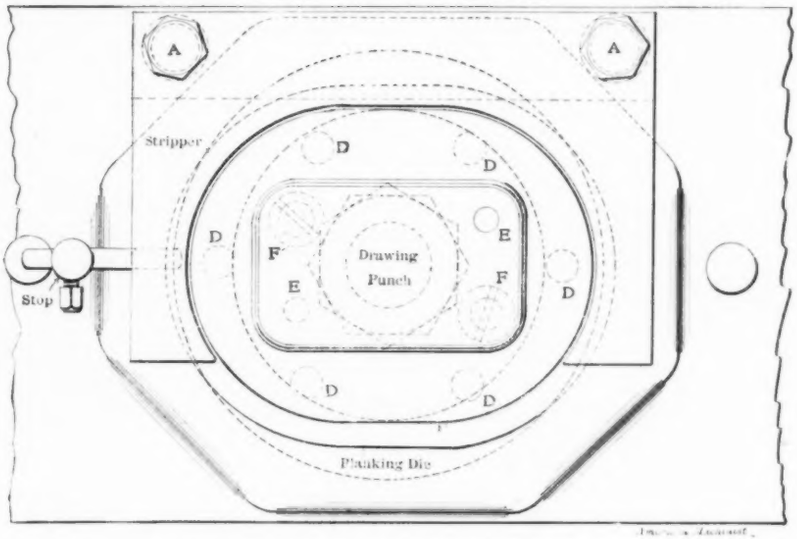


FIG. 7. PLAN OF DIE FOR FIRST OPERATION ON BOX.

as the drawing die, and the pad, which also acts as the knockout. The shape of the cutting edge of the punch is the exact shape of the blank required to form Fig. 1. The manner in which the blanking and drawing of Fig. 1 is accomplished can be understood from Fig. 5, as can also all other points of construction.

The fundamental practical points to be kept in mind when constructing a die of this kind for working decorated stock are as follows: Make three templets, one for the drawing punch, another for the corners, so as to get the proper radius, and a third for the drawing die. Finish the drawing die, the punch plate, the two sides of the blank holder ring and the inside, and the drawing die, before doing any work on the cutting die or punch. Then make your trial draws until the proper blank is found. When you have an exact blank, finish the cutting die and the outside of the blank holder ring, and then fit the blanking punch. Take a cut off the die base after the die has been hardened. For decorated metal allow .006 inch clearance in the drawing die; that is, finish the drawing die .006 inch and two thicknesses of metal larger than the drawing punch, while for plain tin allow about .0035 inch. By doing this there will be no necessity for easing up with files or grinding, and the designs on the metal will not be marred or scratched. Round the edges of the drawing die smoothly; if the draw is very short 1-32 inch will be plenty, and if long increase it accordingly. Be careful to get all the corners of the drawing punch to the same radius and those in the die also (plus two thicknesses of metal and the clearance) and lap very smooth.

For the second operation, that of trimming the edge of the portion of the blank which is still flat and finishing the draw, the double-acting punch and die, Fig. 8, are used. This die is used in a double-acting press. The plunger or punch consists of the holder, a mild steel forging, the trimming punch and the drawing punch. The holder is located on the face of the press ram and fastened by two cap screws through *G G*. The cutting punch is located in a machined seat sunk into the face of the holder and is fastened by four flat-headed screws. The plunger proper or drawing punch fits the inside of the trimming die and is finished with a taper stem for locating and fastening it in the press; the drawing punch portion is finished very smooth and is hardened.

The die consists of the cast-iron bolster, the trimming die and the drawing die. The trimming die is located within a machined seat in the top of the bolster and is fastened by four headless screws *J*. The

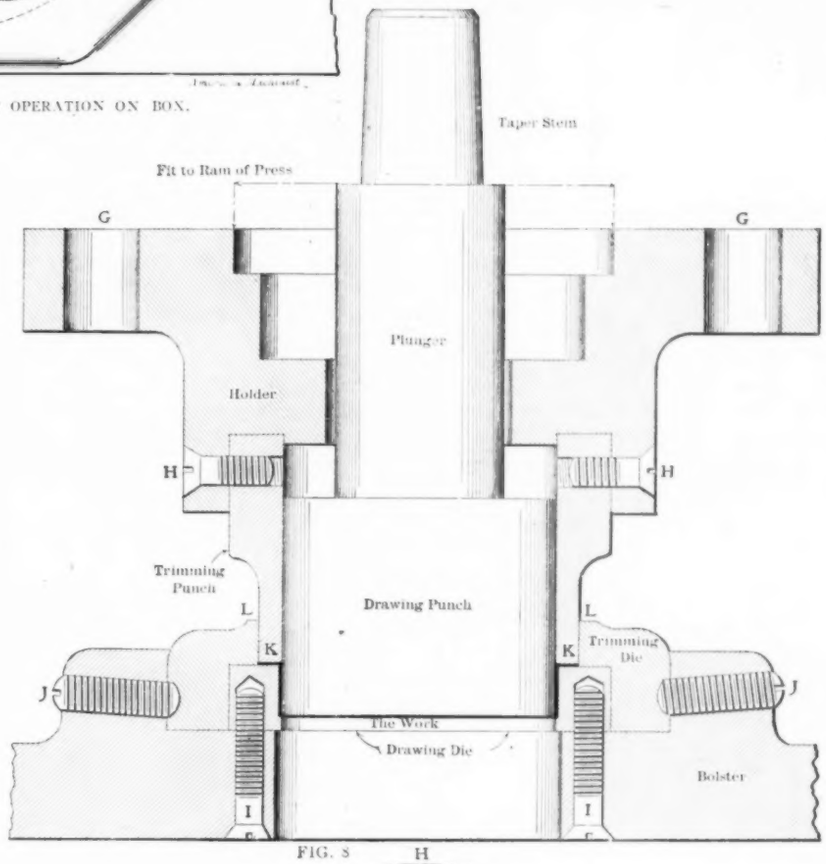


FIG. 8

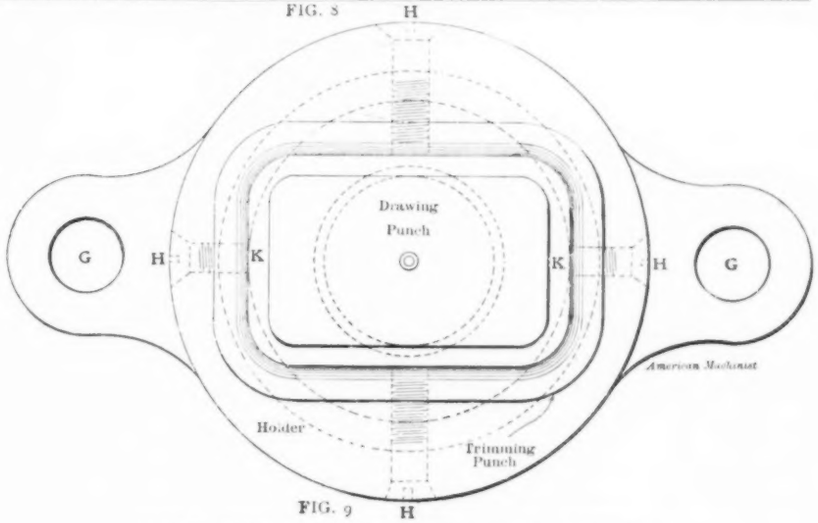


FIG. 9

DOUBLE-ACTING PUNCH AND DIE FOR SECOND OPERATION.

drawing die is located within a machined seat in the bottom of the trimming die and is fastened to the bolster by four flat-head screws from the bottom. The drawing die is left very hard and is lapped to a dead finish and the upper edges rounded, while the lower edges are left sharp and act as a stripper for the work.

The action of this die when in operation can be understood from Fig. 8, in which is shown the work after the cutting punch has descended and trimmed the edges and has stopped (holding the flat portion tightly on the face of the drawing die, by the action of the press), while the plunger or drawing punch continues to descend and draws the metal into and through the drawing die, producing the shell shown in Fig. 2.

The reasons why a second drawing die of this type is necessary in order to produce shells of the type shown are these: In the first place, it is almost impossible to produce shells of any except very shallow depths with true edges without a trimming operation, because the flow of the metal while it is being drawn is such that the slightest defect in the blank will show up in a jagged edge in the drawn shell, and the deeper the draw the greater the effect in the walls of the shells. Secondly, any defects in the construction of the press or in alinement of the ram with the bolster, or any inaccuracy of parallelism in the parts of the punch and die will contribute to raggedness in the walls of all drawn work of rectangular or irregular shape. The only way to overcome this is to trim the edges in a second operation either in a cutting die of the type shown or with rotary shearing cutters.

Fig. 10 shows the die and plunger used to form the bead in the four walls of the shell or box, as shown in Fig. 3. The bead does not extend entirely around the shell, but, instead, runs to within about $\frac{1}{8}$ inch of each corner. Fig. 11 shows a plan of the plunger and Fig. 12 a plan of the die; from the three illustrations the construction and operation of the tools can be understood. The die and plunger are automatic and are constructed the one to expand and the other to contract by the action of the down and up strokes of the press ram. The die consists of first the bed plate *R*, Fig. 12, which is a mild steel forging with a raised surface *X* in the center into which the four sections *N* of the beading die proper are located to move in and out in dovetailed channels. These four sections are of tool steel and have a bead milled out on their faces, as shown by the dotted lines, and in profile at *O*, Fig. 10. They are beveled at *Z* for the faces of the plunger studs *F* and are moved outwardly together by the springs *Y*. The pins *P* prevent them from expanding too far. The shell is located on the spring pad *L*, Fig. 10. This spring pad is worked by the four tension pins *M*, the lower ends of which rest on the large washer *T*, which is located on the spring stud *S*.

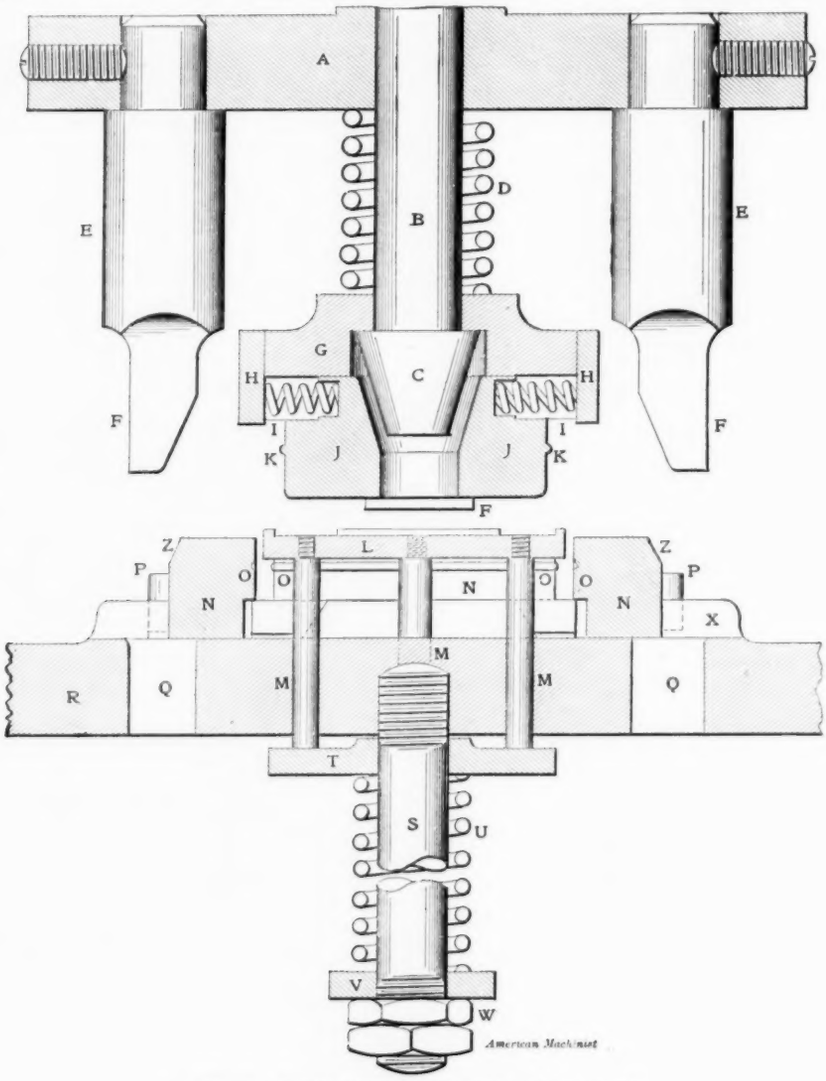


FIG. 10. AUTOMATIC BEADING DIE AND PLUNGER.

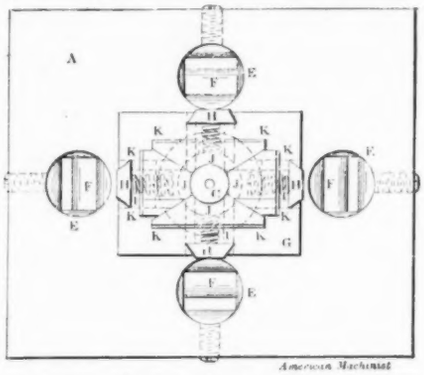


FIG. 11. PLAN OF PLUNGER OF AUTOMATIC BEADING DIE.

The plunger is shown in section in Fig. 10, and in a plan in Fig. 11. The stem (not shown) of the body plate *A* is fitted to the ram of the press. The four inclined faced studs *F* are for contracting the die sections *N*. The expander B is located and fastened in the stem of the body plate by means of a strong taper pin, not shown.

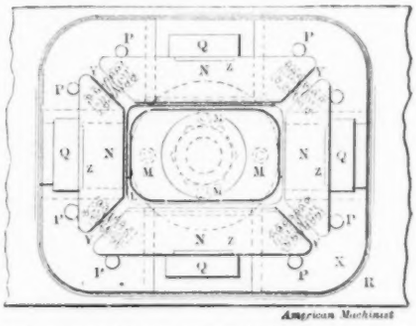


FIG. 12. PLAN OF AUTOMATIC BEADING DIE.

G is the holder dovetailed to admit the four expanding sections *J*. Small pieces *H* are dovetailed into the sides of the holder as backs for the springs *I*. The bead on the sections is shown at *K*. The sections *J* are hardened and drawn to a light straw, as are also the sections *N* in the die.

The manner in which this die is operated can be understood from Fig. 10. The shell is placed upon the spring pad *L* and located by the raised ribs at the sides and back. As the plunger descends, the four sections enter the shell until they strike

the bottom, when the spring pad is forced downward. When the spring pad is halfway down the inclined faces of the studs F encounter the portions Z of the sections N in the die, and commence to contract them. As the spring pad bottoms on the bolster the sections N touch the walls of the shell and remain stationary, while the inclined studs and plunger continue moving downward and the four punch sections are expanded by the plunger at C, the slides or sections expanding until the beads are produced in the walls of the shell. As the plunger rises the four punch sections contract by the action of the springs I and are withdrawn from the shell, while the die sections expand by the action of the springs Y, Fig. 12, and the spring pad L raises the beaded shell to the top of the die to be thrown off by the operator. The shell as beaded in this die is shown in Fig. 3.

The cover, Fig. 4, is produced in one operation in a die of the same construction as the one shown in Fig. 5. As the draw is rather shallow no trimming die is necessary. Instead, in order to produce the edge shown, the blank must be exact at all points.

An Improved Arrangement of the Hatchet Planimeter.

BY FRANK B. KLEINHANS.

The "Hatchet" planimeter is quite commonly known, but is presented as a solid instrument. It consists of an inverted "U" shaped rod, pointed at one end and hatchet shaped at the other. The length is an odd figure, and the instrument is difficult to operate, for the reason that the hatchet must be free to take its own course. The pressure of the fingers in holding the instrument influences its course, so that the readings are in error one way or the other.

Fig. 1 shows this form of planimeter with several improvements. First—Since the hatchet must not be diverted from its course, a pivoted handle A is provided, which, it will be seen, will allow the hatchet to take its free course. Second—The horizontal bar B is bent down at the pivot end, making the instrument less top-heavy and giving a better control over it when tracing a figure. Third—The hatchet C is made movable on the horizontal bar for reasons which will be given presently. Fourth—The bar B is graduated in inches on one side and in centimeters on the other.

The theory of the hatchet planimeter has been given in several scientific journals during the past few years, and will therefore not be given here. I would say, however, that the theory shows that the area of the figure traced is equal to the hatchet reading times the length of the instrument plus some unknown quantity. From a large number of experiments I have found this unknown quantity to be about 2 per cent. of the area of the figure traced. The scale which is shown on the bar B is corrected by this amount. When the hatchet is clamped at the 4-inch mark, the distance of the tangent point of the hatchet to the tracing point is 4 — 2 per cent. of 4, or 3.92 inches. (It must be remembered that the shorter the instrument the greater will be the hatchet reading.) When the hatchet is clamped at the 10-inch mark, the corresponding distance equals 10 — 2 per cent. of 10, or 9.8 inches. The scale between these two points is equally divided. Hence the readings obtained will represent the true area of the figure traced.

FIG. 1. IMPROVED HATCHET PLANIMETER.

tion of the hatchet run around the figure counter-clockwise back to G again. A represents the starting point, A_1 the point at the end of the first and A_2 at the end of the second operation. The average distance P multiplied by L equals the area of the section. The reason for running around the figure in opposite directions is to offset two errors. In the first place one may not guess the center of gravity correctly, and, secondly, the table or drawing board may not be level. The mean of these two readings therefore represents the area of the figure, and should always be gotten in this way by tracing the figure in opposite directions. For convenience in calculation the planimeter is usually set at 10 inches, and when working to a full size drawing, the distance P is conveniently obtained by using that part of an engineer's scale which is divided into fiftieths. By reading to half a division the result is obtained in one-hundredths of an inch, which is sufficiently accurate for all ordinary work.

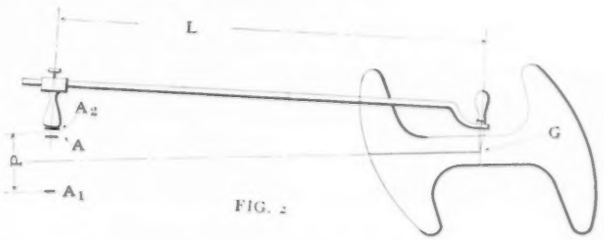


FIG. 2.

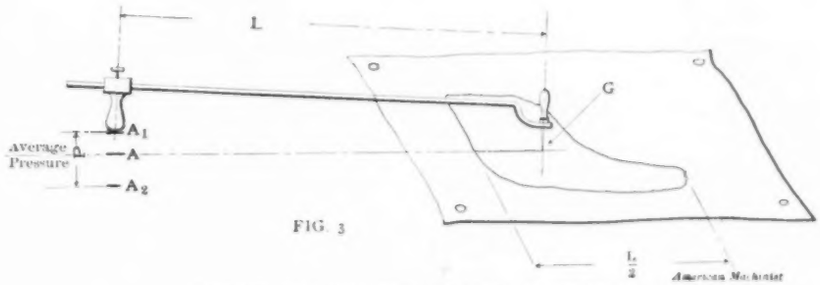


FIG. 3

METHOD OF USING THE HATCHET PLANIMETER.

In Fig. 2 the method of using the instrument is shown. The area to be measured is a section of an I-beam. First locate the center of gravity G by the eye and draw a line to the periphery. Place the instrument in the direction of the line as shown and press the hatchet slightly to make an impression upon the paper. Then follow the line to the periphery, trace the figure clockwise, return to G and press the hatchet again. Without changing the posi-

For some classes of work, as for instance indicator cards, the average hight of the figure is more useful than the area of the figure; and for this class of work the length L of the instrument is made twice that of the card. Fig. 3 shows the application of the planimeter in obtaining the average pressure from such a card, which is fastened to a table by a few tacks. The center of gravity is determined by the eye; a line is drawn as shown; the instru-

ment is set in the direction of the line and an impression made at A. The figure is then traced clockwise and the point A_1 obtained, when the instrument is slid to the starting point A, and the figure is traced counter-clockwise, and the poirt A_2 obtained. The distance P is the average pressure.

There are other cases in which the figure is drawn less than full size, for which one can figure out the length of the instrument to suit some convenient scale and the area of the figure be read off in square feet, square yards, etc. The bar B, Fig. 1, is divided into twentieths of an inch, and by estimating to one-fifth of each of these, the length L can be adjusted to one one-hundredth of an inch. Take, for instance, the case of a firebox sheet for which the heating surface in square feet is desired, but which is drawn to a scale of 1½ inches to the foot, or one-eighth full size.

Let P = the reading on a scale ¼ inch = 1 ft.,

L = the length of the planimeter in inches,

A_1 = area of the figure in square inches,

A_2 = area of full size sheet in square feet,

S = the scale to which the figure is drawn,

= one-eighth full size.

Then $A_1 = P \times L$

$$A_2 = \frac{A_1 \times S^2}{144} = \frac{P \times L \times S^2}{144}$$

$$L = \frac{A_2 \times 144}{P \times S^2} \qquad (1)$$

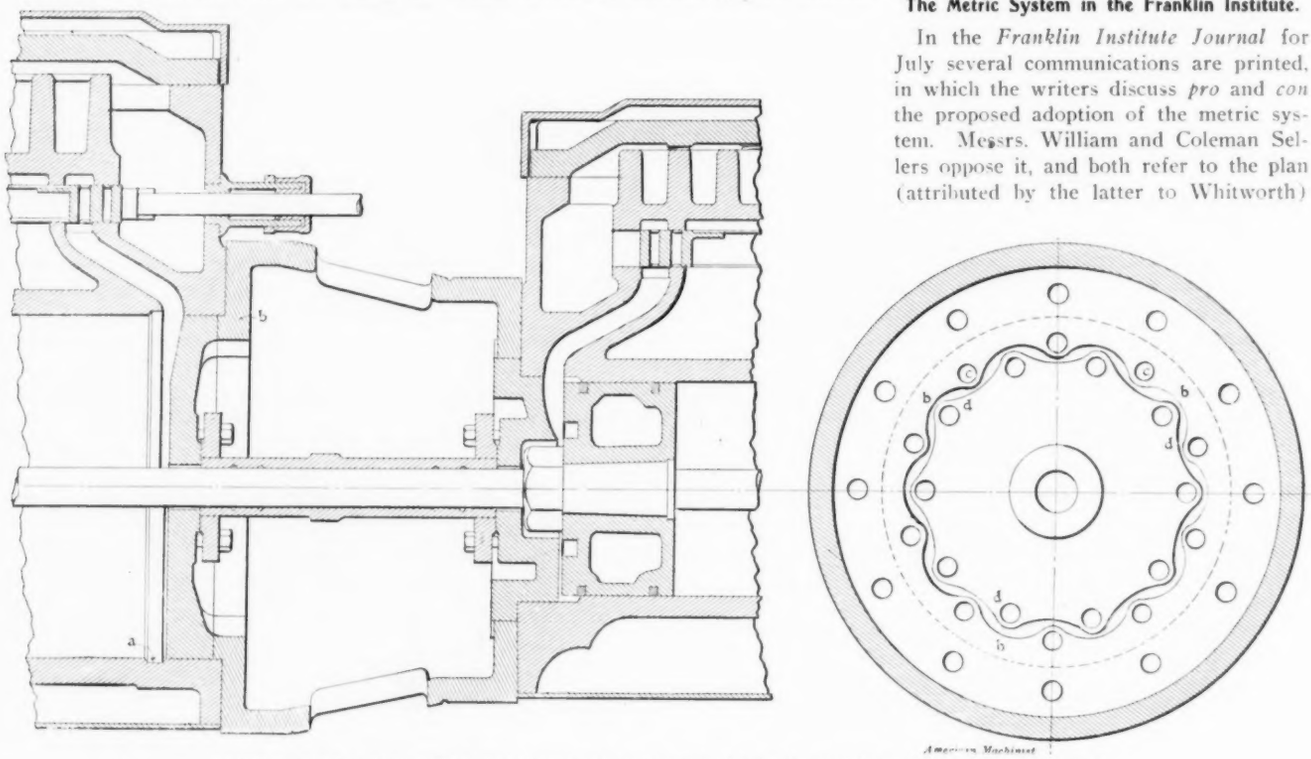
When $A_2 = 1$ then $A_1 = \frac{1}{4}$ inch and (1) becomes $L = \frac{1 \times 144}{\frac{1}{4} \times 8^2}$

$$= \frac{4 \times 144}{64} = 9 \text{ inches.}$$

Therefore, clamping the hatchet at 9 inches, there will be as many square feet of heating surface in the firebox sheet as there are one-fourth inches in the reading.

Tandem Compound Steam Cylinders with Pistons and Cylinder Covers Arranged for Easy Removal.

We illustrate herewith a highly ingenious arrangement used in the tandem compound engines of the Chandler & Taylor Company, of Indianapolis, Ind., whereby the pistons and cylinder covers may be removed through the back cylinder without taking the pistons from the rod, without couplings in the rods and without making the covers in halves.



TANDEM STEAM CYLINDERS ARRANGED FOR EASY REMOVAL OF PISTONS AND CYLINDER COVERS.

The low-pressure cylinder is in the rear and the two cylinders are tied together by a short distance piece. The front cover of the low-pressure piston is turned to fit the true bore of the cylinder, the counterbore being arranged as shown at *a* in the illustration. This cover has no flange, but is bolted to the inwardly projecting flange *b* of the distance piece, as shown, by the row of studs *c*, shown in the end view, and removal of the nuts from these studs obviously permits the cover to be withdrawn into the cylinder. The flange *b* is scolloped, as shown in the end view, and the flange *d* of the high-pressure cylinder is also scolloped, as shown in the same view. The scollops on the two flanges are so disposed as to form ears for the studs and to permit one passing the other, thus permitting the high-pressure head to pass the low-pressure flange into the low-pressure cylinder. It is clear that by removing the back low-pressure head and the nuts from the studs of the inner covers and disconnecting the piston rod from the cross-head, the two pistons, the rod and the inner covers to both cylinders may be removed bodily. The arrangement is, so far as we know, unique.

The method of packing the piston rod between the cylinders will also be noticed, being an adaptation of Professor Sweet's well-known long babbitt-lined bush with grooves for collecting and holding water. The bush or sleeve is, in this instance, we believe, made of brass.

The Metric System in the Franklin Institute.

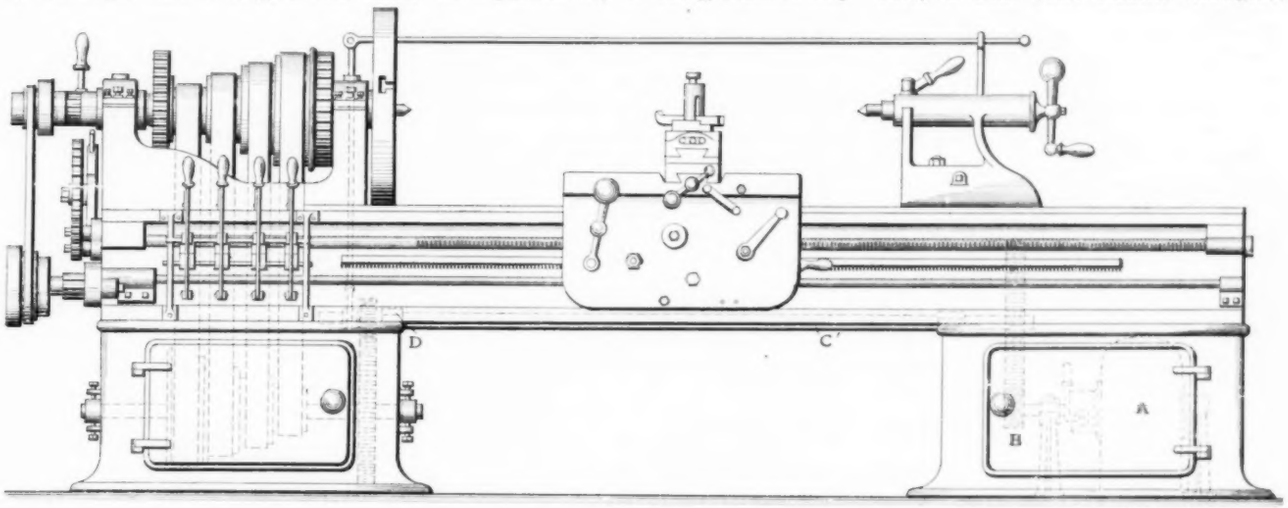
In the *Franklin Institute Journal* for July several communications are printed, in which the writers discuss *pro* and *con* the proposed adoption of the metric system. Messrs. William and Coleman Sellers oppose it, and both refer to the plan (attributed by the latter to Whitworth) of adopting a meter just 40 inches long instead of 39.37, which would make 25 m/m equal 1 inch and enable the change to be made with less disturbance. Benj. Smith Lyman also opposes the metric system, but Prof. Thurston and Jno. C. Trautwine, Jr., as vigorously stand up for it, the latter bringing out a fact not generally known, perhaps, when he closes his letter as follows:

"It is now a quarter of a century since the Franklin Institute, by the narrow majority of 41 to 39, adopted a report opposing a proposition looking to the extended use of the metric system. At that time the Institute might have endorsed the metric system for *the system's* sake; but the time has now come when she *had better* endorse it for *her own* sake. She cannot afford to neglect the present opportunity of reversing her action of 1876."

The Crafts System of Electric Driving.

The accompanying illustration shows the idea of Mr. F. H. Crafts, of the Crafts Machine & Tool Company of Buffalo, N. Y., on a method of driving a lathe by an electric motor and also employing his well-known system of multiple belt driving.

By the illustration shown the motor *A* is located at the right in the cabinet leg of the lathe and on its armature shaft carries a rawhide pinion *B* which engages with a gear on the shaft *C* running to the head end of the lathe within the bed which by another rawhide pinion and gear transmits motion to a shaft in the cabinet leg under the head of the bed which carries a cone pulley driving by belts to the spindle cone. The driving here is by means of Mr. Crafts' well-known system of running four belts simultaneously or a belt on each step of the cone, all of these being slack except the one which is doing the driving and which is tightened by its corresponding lever, as shown. A clutch is provided by which the lathe is stopped, this clutch being located on the transverse shaft *C* at the head end of the lathe and operated by the rod seen passing along the lathe at the top.



CRAFTS SYSTEM OF DRIVING IN CONNECTION WITH A MOTOR.

For Improvement of Works' Surroundings.

The Westinghouse Air Brake Company have offered prizes, not only to their own employees, but to those living in Wilmerding where their works are located, for the sake of encouraging the beautifying of individual homes and surroundings. The prizes cover the improvement of yards and lawns, including neatness and general appearance.

The prizes will be awarded as follows: For ground as a whole, first prize, $25; second prize, $20; third prize, $15; fourth prize, $10; and three prizes of $5 each. Special prizes—For best work in flower culture, $10; for best work in vegetable culture, $10; for best lawn, $5; for best window or porch box, $5. Smaller prizes and honorable mention will be given to those whom the judges decide to be worthy of them.—*Social Service.*

Trade Matters in Portugal, Western Spain and Madrid.

[*From our Special Correspondent.*]

Editor American Machinist:

In Portugal there is a fair, but steadily increasing demand for machine tools, small tools, steam and gasoline engines, motors, electrical machinery, general mill supplies, steam and water fittings, agricultural machinery and implements, windmills, wine and oil presses, locomotives, etc. The whole Portuguese trade in these lines is practically in the hands of two very important firms, viz.: F. Street & Co., 156 Rua do Poco dos Negros, Lisbon; John Harker, 39-41 Avenida, Lisbon. These two firms are of high financial standing and keep an extensive stock in the lines enumerated above. They buy from England, Germany, France and the United States. Mr. Frank Street, the head of F. Street & Co., said to me that if the American manufacturers would only a little bit follow their German competitors in a general way of doing business they would very soon become the absolute masters in the Portuguese and Spanish markets. F. Street & Co. have their own repair shops, in which they employ some 100 men. They are now enlarging their works and are in the market for a certain amount of American machinery.

John Harker, though representative of Sumner & Co., of Manchester, is also in favor of American machinery, of which they carry a good stock. Almost all the oil now sold in Portugal comes from the Vacuum Oil Company, of Rochester, whose general agent for Portugal is Felix Capellar, Rua dos Sapateiros, Lisbon.

The following are some other Lisbon firms—machinery wholesale merchants and importers: Droege & Reddelin, 84 Rua da Princeza, Lisbon; Henry Bachofen & Ca., 22 Rua Nova do San Domingos, Lisbon; Pinheiro Fish & Ca., 37-38 Praca do Municipio, Lisbon; C. Mahony & Amaral, 70 Rua Augusta, Lisbon. All of these are interested in American machines and tools.

Steam and water fittings, as well as small tools, are chiefly handled by the following important wholesale firms: Oliveira e Oliveira, 162 Rua da Prata, Lisbon; Oliveira Machados e Duarte, 68-74 Rua da Prata, Lisbon; Luiz José Torres & Ca., Rua de Amparo, Lisbon; J. B. Fernandes & Ca., 15-18 Largo de S. Tuhzo, Lisbon; Veiga & Ca., 114 Rua da Alfandega, Lisbon.

I learn from several absolutely reliable sources that a certain industrial company in Lisbon is imitating all kinds of American machinery. The company has a capital of $450,000 and is now laying down its own steel works, to make its own steel and malleable iron. It represents quite a number of American manufacturers. It has represented a prominent American builder of agricultural machinery for a number of years and continues to do so; yet it is now imitating their machines in its own shops in Lisbon.

I went also through the shops of Hugh Perry & Sons (Mr. Cannell, manager), shipbuilders at Lisbon. I saw only three American tools in their shops—but not made in America, but imitated in England!

I did not go to Porto, as the whole machinery trade is transacted at Lisbon. Had I gone to Porto I would have had to go back almost as far as Lisbon to get a train for Madrid. Railroads and railway communications are terrible here; it took me 28 hours to go from Lisbon to Madrid.

I can report about Minas de Rio Tinto and Huelva, both in Spain, as follows:

Machine tools used in the Huelva engineering works and in the workshops of the Rio Tinto, Zafra and Tharsis Company are of German, English and American make, the German makes predominating. One of the principal private engineering works in Huelva is that of Matias Lopez. I went all over his shops, which he is now extending. He has several American machines, all of them supplied by Schuchardt & Schütte, of Berlin. Lopez makes small engines, boilers, wine

and olive oil presses, and does general repair work. He employs some 250 men, and his financial standing is first-class. At the same time he imports considerable quantities of all kinds of steam fittings (valves, cocks, etc).

The Rio Tinto Company have extensive workshops at Huelva, in which they employ some 650 men. I spent several hours in their shops. Alfred Atwood is the chief engineer, and George W. Porteous second in charge. While American locomotives were condemned in strong terms, I heard great praise for our machine tools and sawmill machinery. All their shops are equipped with modern English and American tools. Mr. Atwood would like to receive catalogs and prices on machine tools (especially for locomotive work), sawmill machinery and general railway material and track tools. Address: Alfred Atwood, Esq., Chief Engineer, Rio Tinto Company, Huelva, Spain.

There is a large demand for shovels, jacks, hammers, trucks (gage, 2 feet) and all kinds of material used in the mines. The Rio Tinto Company now employ in the neighborhood of 12,000 men. The other large mines in the district are: Compañia de las Minas de Buitron, Huelva; Minas del Banco de Castilla, Peñarroya; Sociedad de Galaroza, Galaroza; Huelva Central Copper Mining Company, Ltd., Cueva de la Mora; Rio Teñido Copper Mines, Ltd., Huelva; Minas Peña del Hierro, Rio Tinto; Compañia Minera Sotiel Coronada, Huelva; The Tharsis Sulphur & Copper Company, Ltd., Huelva and Tharsis.

American manufacturers should correspond with these big companies. It is a pity that the Spanish market has been neglected to such an extent! There are here in the hotel with me *six* German and one English commercial travelers, all in the iron, steel, hardware and machinery line, but thus far I have not yet run across any American traveler.

At Madrid I called first upon Carlos Dal Ré, who was just reading the AMERICAN MACHINIST when I entered his private office. Dal Ré is one of the principal importers of American machine tools in Spain, an honest, enterprising man, with sufficient capital to carry on his large business. He told me that several months ago a man representing a prominent American company making a certain kind of mechanics' tools was in Madrid and proposed to him to place an order for several thousand francs' worth of these tools, saying that if he did so, they would not offer their tools to anyone else. Dal Ré placed the order, paid cash in advance, got the tools and soon afterwards found out that the manufacturers had not only sold their tools to his competitors, but to *his own* customers in Bilbao and Barcelona. He told me that he would *never* place another order with the company. Mr. Dal Ré would like to hear from some prominent manufacturers of lathes of all kinds, drilling machines, milling machines, shaping machines, tapping machines and grinding machines. He would also like to get into touch with a good firm making triplex power pumps. He further on would like to hear from manufacturers of pulleys, hoisting machinery, gas and gasoline engines and chucks. American chucks are now being imitated in Spain. The firm of Larrañaya y Ortea, of Eibar, make "American" chucks; I saw quite a number of them, and they were very good imitations indeed. Even the little wooden box had been wonderfully copied. I saw an invoice from this firm, value 1,520 pesetas, the prices for the chucks being, in part, as follows: 63 m/m diameter, 31.75 pesetas; 102 m/m diameter, 50.40 pesetas; 152 m/m diameter, 78.40 pesetas; 190 m/m diameter, 97 pesetas with 33 per cent. discount. A peseta, at the present rate of exchange, is worth about 14.5 cents American currency. There is an immense demand for chucks in Spain, but our manufacturers must do something, at least in their prices, to be able to compete in the Spanish market. Every machinery dealer in Spain regrets the fact that we have no commercial treaty. While German machine tools pay a duty of only 18.50 pesetas per 100 kilos, ours have to pay 24 pesetas.

Carlos Dal Ré has been doing a good business in American tools. I went through many shops and every superintendent and engineer told me that our tools work "wonderfully" and that they are the "standard makes of the world."

It is only to be regretted that our manufacturers pay so little attention to the Spanish market. Business in Spain must be done on the spot. The Spaniard, as a rule, wants a middleman who can explain the advantages of a certain machine to him, and this middleman must reside in Spain. The market is not so rotten as many of our manufacturers seem to believe. Mr. Dal Ré told me that during the last five years he has not lost a single cent and that all the Spanish manufacturers are extremely proud in paying their bills when due. I have heard the same story all over Spain.

Other Madrid machinery dealers interested in American machinery are: A. F. Abrahamson, 49 Alcala (he told me that his firm is especially interested in gas and gasoline engines, locomotives, steam fittings, motors); Mariano Sichar y Salas, 12 Hermosilla; Riley y Ca., 24 Calle de Arenal (chiefly interested in electrical machinery, electrical supplies. Would like to hear from good houses for telephone supplies. It is a good, enterprising firm of standing); Schomburg y Caballero, 19 Sagasta (all kinds of industrial machinery and steam and water fittings); Esparza Hermanos, 48 Serrana; Juan Wenzel y Ca., 28 Carrera de S. Jeronimo (large electrical dealers). Mr. Wenzel told me he would like to hear from some good manufacturers of electric fans and small electrical fittings and supplies.

HENRY L. GEISSEL.

Echoes From the Oil Country.

LITTLE THINGS WE CAN'T FORGET.

Some little jobs leave impressions altogether out of proportion to their size. There is a city west of Lake Erie, where, situated as it is high up among the hills, the wind blows sharp and cold and the temperature gets entirely too low for outside jobs to be longed for in the winter. When a man finds the thermometer 20 degrees and more below zero for a week he begins to know it is cold, and he can feel the shivers coming when the foreman steers his way with a stranger in tow.

"Get all the little narrow chisels you have and go out to the siding and take out that broken piece of cylinder cock. The yard engine ran off an open switch and knocked off a cock and they can't get it out. He has another cock to put in, and it will save running to the end of the division or having a man come up if he can get us to do it, and, besides that, it will save him reporting that he was off the track. It's pretty cold out there, but I guess it won't be a very long job."

As it was to me the foreman was talking, I gathered up a number of narrow chisels, put on my coat, picked up my hammer and made for the siding that was just outside the shop and ran east and west; and the wind blows from west to east there.

The locomotive was headed west and had broken off the cock on the back end. It had a ¾-inch thread (pipe thread) on the outside and a ½-inch hole, or about that, on the inside. The engineer had driven a square reamer into the hole and broken it off even with the end of the brass. That gave a very limited chance at the brass.

I lay down on my back in the snow with my head on the rail and my feet to the west; this gave my right hand a chance. I could get a blow of a couple of inches by hitting myself one way. I tried rolling into different positions, but succeeded only in getting snow up the legs of my trousers as well as wind. And how the wind did blow! Some of the fellows grinning at me from the shop windows afterward said they could see the snow coming out at my collar. Soon I went in and perched by the steam pipes while a mate ground the chisels. After another round I was in to get a piece taken from my eye. Each time I came in I tried in vain to get someone else to have a try at it. The engineer to keep up my courage threw down his seat cushion for me to put my head on, and scraped away what snow he could while I was in the shop. While I worked hard I did not sweat, and I was well pleased when I saw signs of loosening in the reamer. When I got that out it was a very short job to chip out the remainder of the brass and screw in the

other cock. Then I went in and tried to thaw out. Like many another job, it would have been much easier before someone else had tried it.

. . . . . .

"This man runs the grist mill back of the shop. He wants a set-screw taken out. It is broken off. Maybe you can back it out; if not, you will have to ratchet it out. You might try backing it out first, and if you can't start it, see just what you will need to drill it out."

The man was standing there, dressed in white that did not show the flour dust very much, and I took a couple of blunt gouges, a diamond point, my old stand-by, a set with a flat end about ¾x⅜ inch, and my hammer and went with him.

I rather liked broken set-screws, after having been able to take out several where others had failed, and I had learned several tricks about their ways that often made them let go. The kind that was just screwed down until broken off or that had been broken by something striking them would often come out without trouble. Pounding on the hub near them or pounding on them would make them ease up a little, when careful coaxing in the right place with the set, after a spot had been chipped for it, would bring it out. And careful coaxing is what is needed, as one wrong blow will sometimes jam a thread so that the only way then left is to drill. Those who have had to drill out a hardened set-screw in a cramped place know what fun it is; only they don't lay off for a chance to do it, like they do for fishing. Sometimes it will take a number of minutes' coaxing to get the first signs of starting, but as it sometimes takes several hours to drill one, patience pays.

I was a green hand around a flouring mill, and had very little idea as to where they had set-screws, but after getting away upstairs I found out where this one was. About 8 feet under sor e kind of a cleaning machine was the spot. There was something like 20 inches of space between the bottom of the machine and the floor, and the way to get in was either to lie down on my back and draw myself in or lie on my belly and crawl in. As the floor was thickly covered with dust I asked for a broom before beginning.

"I'll get you a broom, of course, if you want one, but you don't need it; you'll only get a little on the outside, and you'd get that on anyway;" but he brought a broom and I cleaned out what I could, then I lay down on my back and hitched myself in under the machine with my tools.

The first thing was to have the shaft turned so that the set-screw came where I could work at it. The moving of the shaft brought down a nice little shower of flour all over me, and the first touch of the hammer brought clouds of it. Mouth full, eyes full, ears full, nose full. A sneeze brought down more, so did every other blow of the hammer.

After my neck got to feeling as though it would fall in two I had some bags passed in for a pillow and the work was continued. Finally I crawled from under that machine with a set-screw in my possession and an appearance not usual to machinists. A suit of overclothes that has seen several days' service in a machine shop makes a beautiful ground work to take the color from a flour mill.

I was greeted with great glee by my shopmates on my return to the shop. I brushed myself as best I could before leaving the mill, but one man came up and said: "You had better keep off the street, for if Blank sees you he will have you arrested for stealing flour." Blank owned the mill. Another one said: "I always believed in spirits and such things, but I never happened to see one, but thought I had for sure when you came in. They are a sign of sickness or of some one going to die, and if I was you I would try to see if I couldn't make the fellow that put the flour on me feel at least a little sick."

I was the regular outside man, but sometimes there were two calls at once or a man would be wanted when I was out. On such occasions one of the other men would have to go and not always to have an agreeable time, either. On one such occasion a man was sent across the hills to a tannery several miles away. It was in the winter, but a thaw had come and the ground in town was bare. He started with a horse and buggy and a gum overcoat, got there without much trouble and did the job, not getting done until after dark and too late to return that night.

During the night there came one of those sudden changes, with a strong west wind and the thermometer went tumbling toward zero, making each pile of drifted snow a bank of ice and turning roads into skating rinks. The only way to get back was over those hills facing the wind. The horse was none too sharply shod, the buggy wanted to go anywhere except down the road where it should go, and it took all the efforts of the man walking to keep it pushed up enough to keep it from rolling over the hill in places. He had waited until about 9 o'clock in the morning before he started across, and it was between 3 and 4 o'clock when he came staggering into the shop chilled through and ready to drop, very much disgusted with outside jobs. He knew now why I bundled up when I had to go out of town.

Another man was ready to thrash me on the slightest provocation because he went out and waded two and a half miles through a stiff clay and then waded back again. Said he had to wade out to get there and the only way to get away again was to flounder back. He didn't like the place or the people or the way they treated him, and I guess he didn't like me, either, because I wasn't there to be sent out. He didn't like it, either, because I suggested he might have gone across through the woods instead of following the slough of despond that served for a road, and he declared he would quit his job before he would go out again to such a place, and that if he lost his place he would give me a thumping. After he got started through the mud I suppose he got so mad he couldn't think of anything else, and so failed to see how he could have gotten along some easier.

I was one day tramping through the heat of a mid-summer sun, carrying a heavy load of tools, when, looking back down the road, I saw a rig coming and slacked up until it caught up to me. A wagon load of nitro-glycerine isn't just what I would choose to ride on if I had a choice; but the driver was sober, the road was up grade and very dusty, and I was tired, so I rode. As that man was hauling it as a regular thing, he had to take the chances all the time, and I was willing to take some chance for the sake of getting along a little faster and resting at the same time. I wouldn't have gone out of my way to get a chance with him, as I choose a different rig for a pleasure ride. I am not sure, anyway, that getting blown up is any worse than getting a sunstroke or bursting a blood vessel.

W. OSBORNE.

In the current number of the *Century Magazine*, Dr. Weir Mitchell has a story about a wealthy and cranky mechanical engineer who, while he lived, cordially hated all his relatives, but upon his death bed sent for a nephew and told him that in his will he, the nephew, was to be greatly benefited—all the uncle's property was to be left to him. This property was found to consist of a collection of gems of fabulous value which were in a safe deposit vault. Upon the key to this vault being delivered to the nephew, he opened it and found on top of a steel box a letter addressed to himself, which letter contained a list of the gems within the steel box; but the letter also conveyed the information that the box contained, along with the fortune in gems, some of the engineer testator's specially invented high explosive, which would be sure to detonate as soon as the lid of the box should be raised. The story goes on to describe the various schemes devised for opening the box without setting off the explosive, all of which were discarded one after another as being impracticable; the final result being that the nephew was driven nearly crazy by his desire to possess the gems—a desire effectually restrained by his further desire to continue living. We hereby offer our solution of this difficulty: We should simply immerse this box for about twenty-four hours in liquid air, after which we should expect to open it with impunity, because no explosive we ever heard of could be made to explode after having been subjected for twenty-four hours to a temperature of something like —400 degrees Fahr.

Letters From Practical Men.

Blueprinting Frame.

Editor American Machinist:

I send herewith a sketch of a simple and convenient frame for blueprinting. Fig. 1 is a section of the frame in position in the window, and Fig. 2 shows a corner of the frame to a larger scale. The two frames are made of pine or cherry. The corners can be half-checked or, as the maker wishes, so that they will be rigid. Frame *A*, hinged at *B* to the main frame *C*, is rabbited to receive the glass *D* and have clearance for the padding table *E*. The glass is put in place and secured as shown with strips of wood. The padding table is made of boards about $\frac{5}{8}$ inch thick, or, in other words, thick enough so that glass and padding table fill the rabbited space snugly, with ample clearance at the edges, as shown. Two layers of padding—called "table padding" or "silence cloth"—are placed on the padding table, drawn tightly over same and secured at edges with tacks, as shown. The main frame *C* is mounted on four rollers or casters to run on two wood tracks, which are made long enough to accommodate the frame inside and outside when the window is down. A liner *F* can be attached to bottom of sash *G* to close the opening made by the track.

To print, open frame *A*, lay printing paper on padding with tracing on top; stick a pin in each corner and drop the frame. The weight of the frame and a hook *H* make a perfect contact.

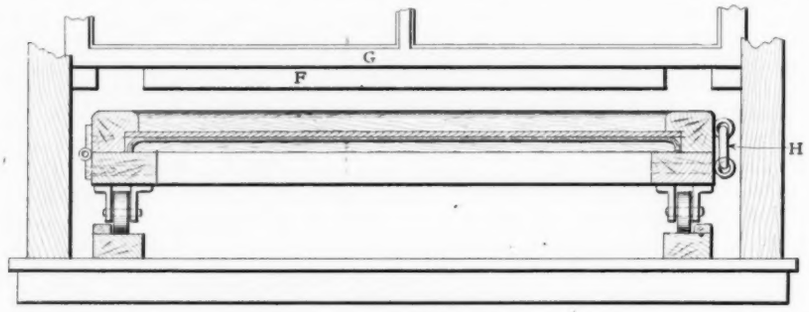


FIG. 1

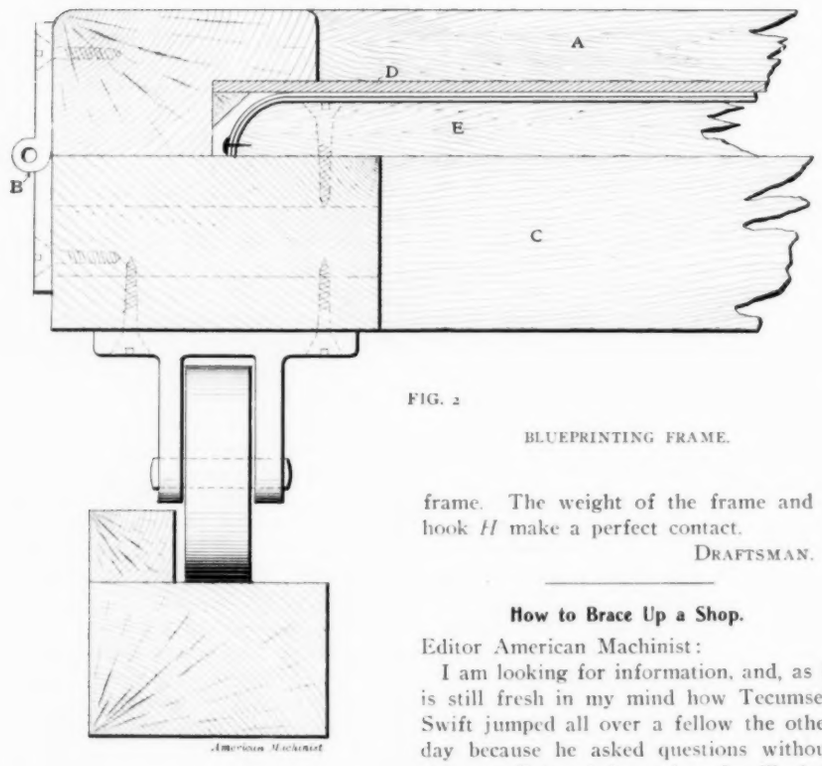


FIG. 2

BLUEPRINTING FRAME.

DRAFTSMAN.

How to Brace Up a Shop.

Editor American Machinist:

I am looking for information, and, as it is still fresh in my mind how Tecumseh Swift jumped all over a fellow the other day because he asked questions without giving sufficient information, I will shell out first and then wait to see what the other fellows have got to throw in.

We are running a small shop employing about two dozen men and "have troubles of our own." It appears to be impossible to get the men to assist in keeping things around the shop clean and in order. Tools are not put back where they belong, taps are put away dirty, drills are left in their sleeves and sockets, toilet paper is strewn over the floor in the closets, etc. In short, the situation is such that at times it has driven me into being so unreasonable as to think that part of it is done intentionally.

It probably is not, but inexcusable negligence is to my mind a mild term for such doings, especially as there is a place provided for everything and labels are up everywhere indicating where all tools belong. I might post signs around the shop instructing the men to take better care of things under threat of discharge, but to what benefit?

Once, in an Ohio machine shop, I counted five such signs in a bunch, and all threatening discharge for violation. The shop was dirty, disorderly, and I don't know what not. I've concluded that such signs are at best an eye-sore to the well-behaved and the other kind pay no attention to them, except perhaps to fire the remains of a chew of tobacco at them occasionally. Consequently we have no rules and regulations posted in the shop. I tell the boys that intelligent men know enough to behave well without them, and thus I try to appeal to their sense of honor, but the temptation to be disorderly and slothful is apparently too great, and little improvement is noticeable.

I suppose most of your readers would recommend the adoption of stringent measures, perhaps the discharge of one or two of the worst ones when caught in the act, but my impression is that we'd have to do some discharging "semi-occasionally" to keep our desires for orderliness fresh in their minds, and besides, as compared with curing a man of such habits, discharging is killing him as far as *our* shop is concerned, and I am not looking for advice on killing, but on curing.

Discharging rarely makes men better; on the contrary, I think it often makes a man worse to be humiliated in the presence of others; and, as concerns those who are left, it may produce a sort of fear in some, but with the majority it is more likely to be contempt, and which of the two evils is the lesser I cannot say.

Now, what I would like to know is how others have tackled this problem and how well they have succeeded. I do not expect your readers will be falling over each other offering solutions, but as men are a good deal alike the world over there must be others in charge of shops who are annoyed by the same evil and who would welcome suggestions on the subject.

In conclusion, allow me to state that we do no piece work; we sweep the floor twice a week and offer every encouragement for system and order. Also that we employ men O. K. morally and otherwise, and no hoboes.

DUTCH.

A Guard for the Jointer.

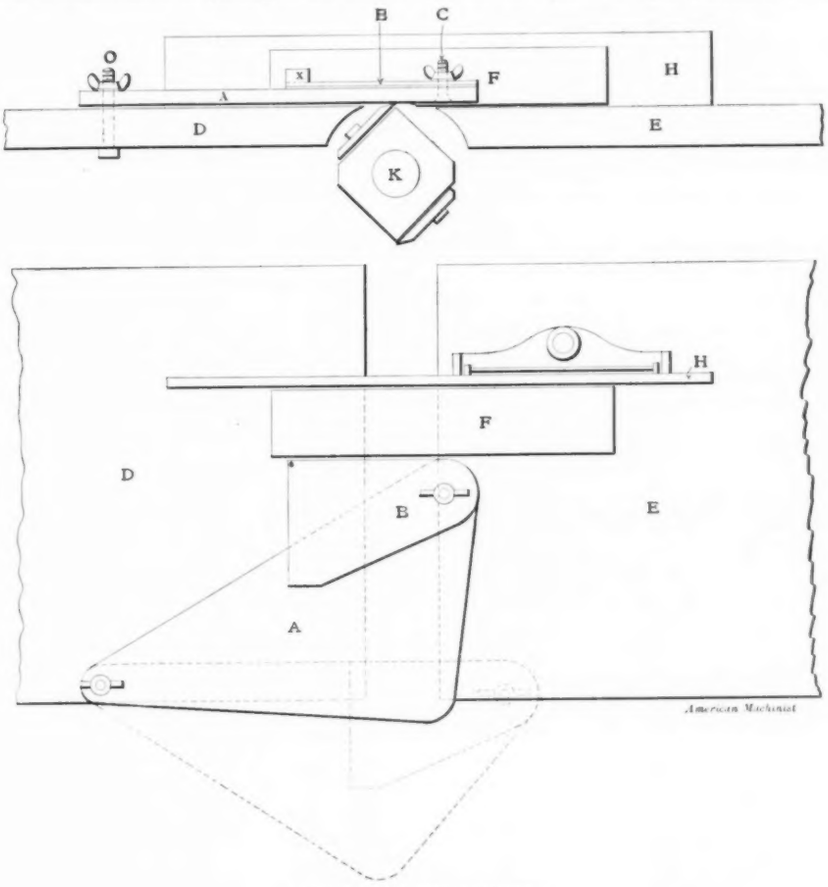
Editor American Machinist:

Having read with great interest at page 766 Mr. Ferd. Wertheim's "Planer vs. Buzz Saw," and, looking back over a period of twenty-five years, I find that fully 40 per cent. of the accidents that have occurred within my own personal knowle'ge

and observation have been due to the faulty construction of the machines, while the other 60 per cent. have resulted from inexperience, incompetency and carelessness of the operators.

While many safety appliances have been introduced, there are still many lacking. A well-known builder of wood-working machinery, whose machines we used principally, paid us periodical visits, and upon each occasion he never failed to inquire if we knew where any improvements could be made to turn out work faster or to make the machine safer in any way for the operator.

In regard to flying knives we had two cases in our shop. In one instance it was due to carelessness in putting in the knives



A GUARD FOR THE JOINTER.

—that is, in not screwing up two bolts that held the two knives in the cutter head. There were two knives in this head and one flew out, but fortunately hit only a post. The machine was stopped and the other knife was found to be loose. It had been driven back, but had not entirely worked itself loose enough to fly out. After that all knives were secured to the cutter head by two bolts, instead of one as formerly, and we were never troubled again in that way.

We also had the guards or covers over the knives made heavier and with a flare to one side, so that in case anything should get loose it would strike the cover at an angle and not fly out straight. As a result the next accident was a knife breaking off. This was due to a flaw in the steel; but here our forethought saved us perhaps a serious accident, as only the cover was broken and the bed of the machine was chewed up a little, but that was easily repaired.

In most shops now all dust and shavings are drawn away as fast as they are made by a blower, in which case all knives, except on variety machines and jointers, are completely covered, therefore making it much less dangerous.

It is a singular fact that firms building band-saws do not, as a rule, put on a guard to prevent the saw from running off the wheels both top and bottom. They should also place a light partition of ⅜ or ½-inch matched stuff in front of the lower wheel to prevent anything from coming in contact with it while running.

A few of these guards will be found on band-saws, but they have been put there in most instances by shop hands for their own safety, while in many shops they are absolutely without any guard or protection. As a general rule, it is the inexperienced person who meets with an accident, and every possible precaution should be taken to avoid it.

A few years ago I was running a 24-inch double planer. There were two heads that dressed both sides at one operation and ran 5,000 turns per minute. It was an old planer and the guard over the top knives only covered them about half way back, and when the machine was running the knives looked very much like a roller. We had a draftsman from Cornell at that time, and he came over to inspect what I was doing. Remarking "what a smooth roller that is," and, reaching out his hand, he was about to place it on what he apparently thought was a roller. I made a jump for him, and after my explanation he turned pale. That roller "wouldn't have done a thing" to his hand.

I mentioned this incident to our machine man the next time I saw him and I notice that since then the guards or covers have been extended further back, covering the knives entirely—of course allowing space for the shavings to come out.

The machine which wood workers generally consider more dangerous than any other is the jointer. There is absolutely no guard covering or any device attached and sold with any jointer that is on the market at the present time, and, as any woodworker or patternmaker will agree with me, there is none more necessary.

A suggestion made in this line to a prominent builder of these machines in the West some time ago, from whom our firm purchased a jointer, was promptly rejected as N. G., and I was sat on for my trouble. So I had made and put on the guard as shown in the sketch. It is a very effective, simple and inexpensive device, easily applied or removed from the table. *A B* is the guard and *O C* are two thumb screws. *D E* is the table of the planer, *K* the cutter head, *F* the work and *H* the guide or fence. Fig. 1 shows the guard in position for use. The dotted lines show it drawn back for wider stuff. *A* is a piece of ⅜- or ½-inch hard wood, 3 inches wide at one end, 15 inches wide at the other, 24 inches long one side and 35 inches long the other. On top of this is placed *B*, a piece of galvanized iron, 1-16 inch thick, 4½ inches wide, one end 10 inches wide, the other 12 inches long one side and 15 inches the other. On *B* the lip *X*, about 1½ inches high and 2 inches long, is bent up to catch hold of when moving it. *B* is attached to *A* at *C* with a countersunk head bolt with thumb screw *C*. *A* is attached to the front table *D* of the jointer by drilling a hole for bolt *O*.

In using the guard, first loosen both thumb screws *O* and *C*, place the wood *F* on the table *E* against fence *H*, bringing guard *A* up close to the wood. Now, catching hold of *B* at *X*, push it over until the stock just clears it, tighten your thumb screws and the knives are completely covered, except where your piece moves along, and should your hand slip off the piece of wood it will drop on the guard and not on top of two knives running 5,500 per minute.

In rabbiting short pieces up to 18 inches long, the guard can be swung around to the front of the table out of the way, and

after using it can be swung back again; or in rabbiting long stuff it can be removed in half a minute.

There is more danger from this source than from any planer or flying knives that

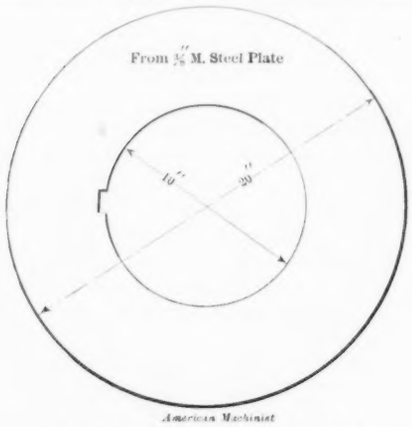


FIG. 1. THE WASHERS TO BE CUT.

I know of, and I think the AMERICAN MACHINIST would be conferring a deep and lasting favor on its readers, especially patternmakers, by placing this matter before them and the machine builder for consideration. C. NEIL.

[In this connection it is convenient to refer to a new form of guard for a jointer which has been devised by an English mechanic, and which is mentioned, as follows, by *The Woodworker*.—Ed.]

"It is in the form of a roller suspended from a frame attached to the fence and swung so that the roller hangs clear of the knives and swings freely in working stuff under it. The fact of the roller being in the way compels the operator to swing his hands clear of the head in handling the stock being worked, and lessens the chance of injury. The only objection to it lies in the fact that an American mechanic will not tolerate any hamper of that sort on a machine, as it interferes with the rapid manipulation of the work."

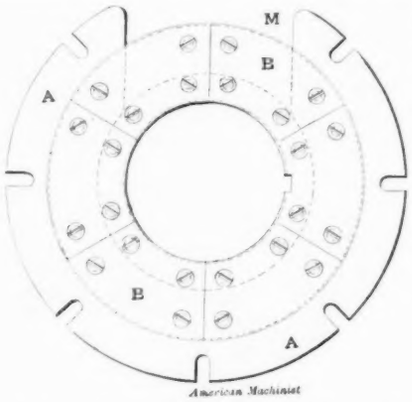


FIG. 3. PLAN OF DIE FACE (REDUCED SCALE).

Hydraulically Operated Punch for Cutting Large Washers.

Editor American Machinist:

The accompanying drawings show details of a die for cutting large washers from ⅜-inch mild steel plate. The washers are as shown in Fig. 1, being 20 inches outside diameter and 10 inches inside diameter, with a keyway 1 inch wide by 5-16 inch deep cut out from the inner circumference. They were required to be perfectly flat.

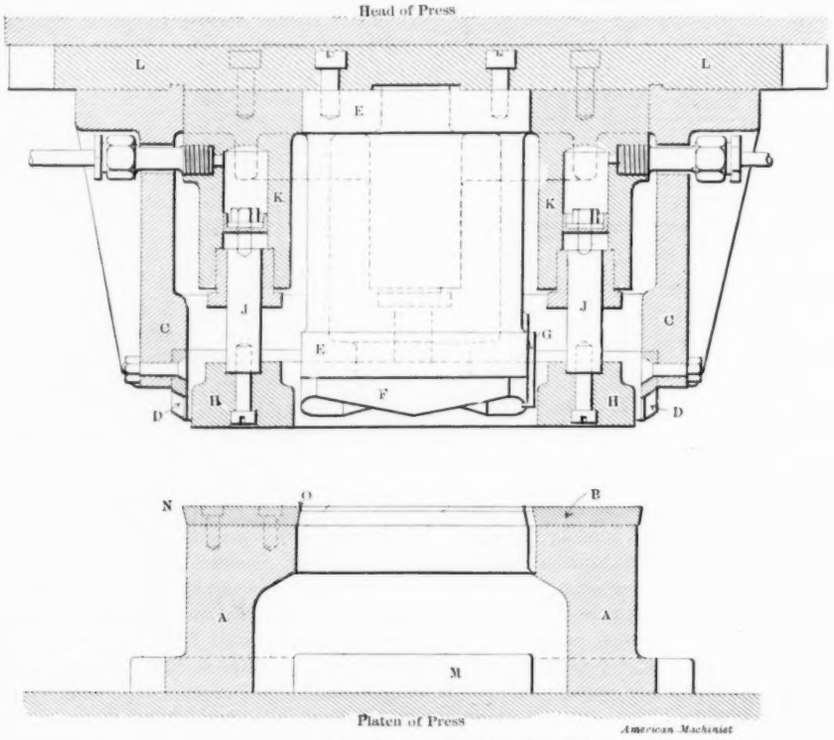
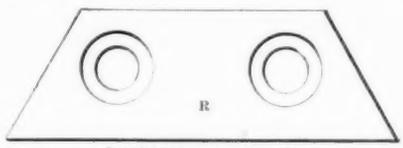
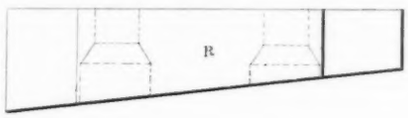


FIG. 2. SECTIONAL ELEVATION OF DIE.

Fig. 2 shows a section through the die and Figs. 3 to 5 show details of the various parts. In Fig. 2, *A* is the die block with a hardened steel face *B*. C is a casting carrying a hardened steel lip *D* for shearing the outside of the washer. *E* is the punch block with a steel face *F* and carrying the punch G for cutting out the keyway. *H* is the flattening and stripping pad, *J* the stripping rams, and *K* the stripping cylinders, four in number. *L* is a back plate on which the various parts were mounted. The die was used in an hydraulic press, die block *A* being fixed to the platen, and plate *L*, carrying the punches and strippers, secured to the head of the press.



Detail of pieces for Face F



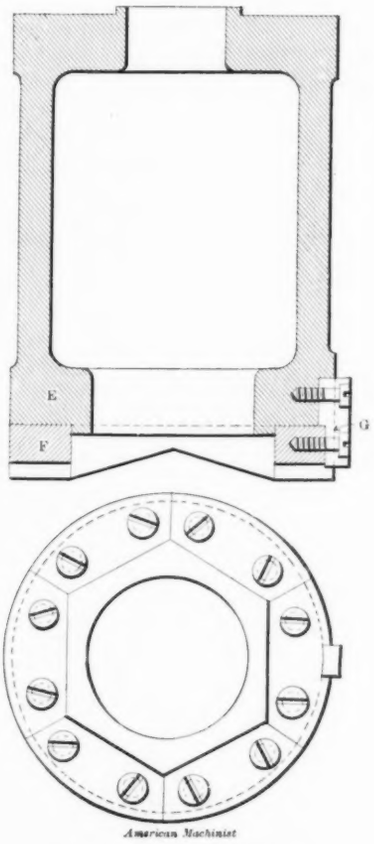


FIG. 4. DETAIL OF PUNCH.

Fig. 3 shows details of the die block. It is of cast iron and made with a gap *M* for the removal of the burr cut out by punch *E*. The steel face B was put on in six segments secured by the screws shown. After the segments were fitted in place the block *A* was chucked in a lathe, the face was trued up, and cutting edges *N* and *O*

were turned to size and beveled. A small allowance was left for grinding after the segments had been hardened and tempered.

Fig. 4 shows details of the steel lip *D* for cutting the outsides of the washers. This was made in eight pieces, cut from a 3x¾-inch bar of tool steel. They were milled on the edges only and beveled, as shown at *P*. They were then heated and bent to fit within the recess formed in the mouth of casting *C*. After being carefully fitted within the recess and secured by the

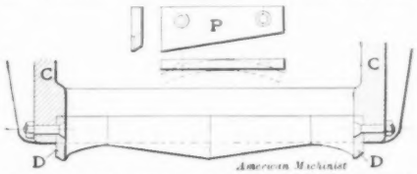


FIG. 5. SECTIONAL ELEVATION OF CUTTING LIP D.

countersunk bolts, *C* was chucked in the lathe and the steel lip *D* was bored to size, leaving a small allowance to be ground after pieces *P* had been hardened and tempered and finally secured in place. The detail of punch *E* is shown in Fig. 5. The body was of cast iron with a hexagonal projection shaped out on the face. Six pieces of tool steel, shaped as shown at *R*, and fitting against the sides of the hexagon, were secured to the bottom of *E* and formed the steel face *F*. *E* was then centered in the lathe and the outside diameter of face *F* was turned, leaving a small allowance for grinding after pieces *R* were hardened and tempered. Punch *G*, for cutting the keyway, was secured to *E* and *F*, as shown. The face *F* of the punch had in this way three cutting points, and the steel lip *D* had four.

When set up in the press, as shown in Fig. 2, the stripping pad *H* projected ⅜ inch beyond the cutting points of lip *D*,

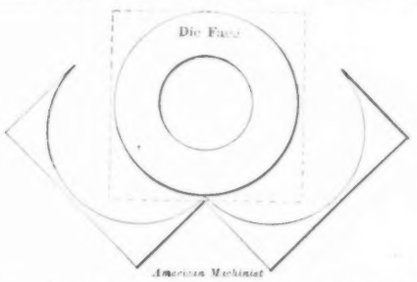


FIG. 6. REMOVING SCRAP FROM OUTSIDE OF DIE FACE.

and the points of *D* projected ⅜ inch beyond the cutting points of face *F*.

The cylinders *K* were constantly under pressure, and the plate being cut was by this means firmly held down on the die face by the pad *H* before the lip *D* began to cut the outside, and *D* was well through before face *F* began to cut out the 10-inch hole. On the pressure being cut off from the ram of the press the pad *H* was at once returned to its original position, stripping the cut washer from between punch *F* and lip *D* and depositing it perfectly flat on top of the die face. The actual travel of the die required to cut through the ⅜-inch plate was 1⅞ inches, and we found that it required a net pressure of from 175 to 200 tons to make the cut.

The washers were cut from square cut plates. They were set so that one edge was always shaved through, and it was then an easy matter to pull open the scrap as shown in Fig. 6, and remove it from around the die block *A*. As already mentioned, the punching from the 10-inch holes dropped through the die block and was removed through gap *M*.

C. PATTERSON.

Case-Hardening to a Line or a Dot.

Editor American Machinist:

I note with interest the communication at page 911, from L. O. Danse, on local case-hardening, and having had considerable experience with case-hardening, I venture the following details of the operation as I have practiced it, and which may be used on very intricate jobs of hardening with absolute accuracy as regards the limiting of the parts of the surface which are to be hardened, it being possible to so control the hard and soft surfaces that a line 1-32 inch wide or a dot 1-32 inch in diameter may be left hard or soft at will.

The surface which is required to be hardened, and only that surface, should be coated with a moderately heavy coat of some quick-drying material (preferably black japan enamel, as that may be baked on and adheres more closely than anything else, provided the work is thoroughly cleaned). After this is dry the work is taken to the plating room and is plated with a medium heavy coat of copper, care being taken in the cleaning, prior to immersing in the plating solution, not to disturb the japan, by potash solution or otherwise.

The piece is now ready to be carbonized, which for ordinary purposes requires about three hours' roasting in bone dust at a *bright* red or yellow heat. A lower heat does not open the pores of the iron enough for it to absorb the carbon freely. It should then be removed from the furnace and allowed to cool in the bone dust slowly. It should not be removed from the bone dust until cold, when it should be heated to redness in an open fire (charcoal) and plunged into cold water. If a piece of the work is broken a very fine velvety surface will show, which is far from the crude result of the process if the work is taken from the bone dust and plunged into water immediately after the roasting process. Then a coarse granular surface would be the disgusting sight exposed to view upon breaking the piece.

Upon trying the work with a file it will be found that the copper has effectually blocked the absorption of carbon and that the japan has burned off and allowed the carbon to soak in to a depth of about 1-32 inch. Repetition of this process deepens the hardening and does not deteriorate the structure of the metal. SENECA.

A Beam Compass Clamp.

Editor American Machinist:

I send you herewith photograph of a beam compass clamp which I have devised for the use of students in the mechanical engineering department.

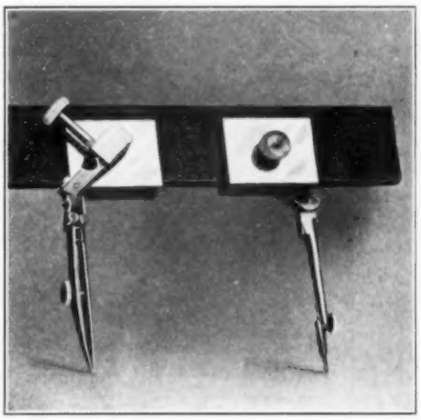


FIG. 1. A BEAM COMPASS CLAMP.

The part that is loaned the student by the department consists simply of the two pieces which clamp upon the bar and have the little lugs on one side. The student inserts, from his own set, the needle and pencil point, or pen. The fine adjustment is made by aid of the hinge joints, and the location of the lug, at 45 degrees, gives the joint a position in which it works easily and permits adjustment either way.

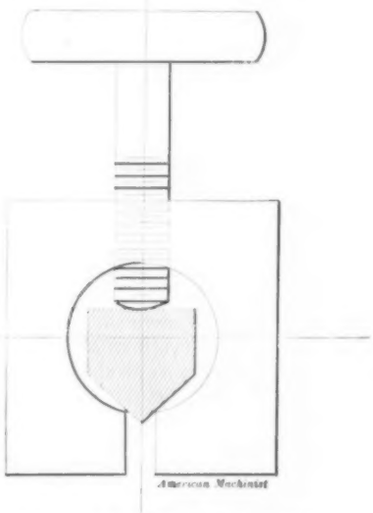


FIG. 2. CROSS-SECTION OF CLAMP.

The adjustment can often be conveniently made simply by exerting a lengthwise pressure on the bar (the needle point being stuck into the paper), and no reaching under the bar to turn a screw, etc., is needed.

The shape of the hole to take the different forms of shanks of the various makes is as per sketch, one form of shank being shown cross-sectioned in place.

The clamps have been in use in the department for some little time and seem to be a rather satisfactory scheme.

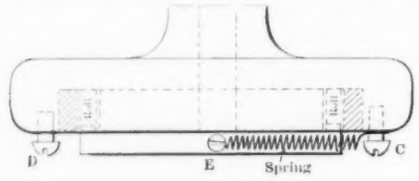
G. A. GERDTZEN.

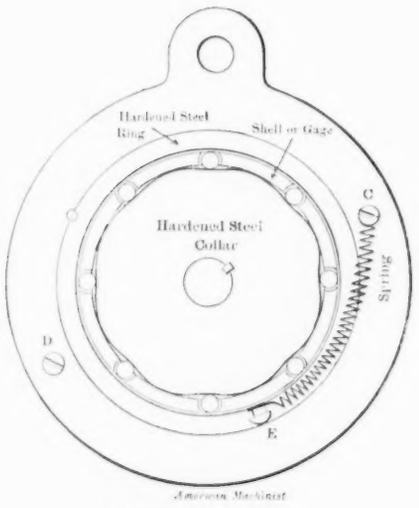
University of Illinois.

An Anticipated Invention.

Editor American Machinist:

At page 910 I see illustrated a reversible ratchet motion patented by a Mr. Strong. I send you a sketch of a similar device which has been in use for the last seventeen or eighteen years, having been patented by myself July 4, 1882. Within about one year we have made reversible roll feeds for power presses using a construction like the sketch. This will turn the inside collar in one direction if the spring is attached at the screw *C*, while it will work in the opposite direction if the spring





A REVERSIBLE CLUTCH.

is attached to screw *D*, the other end of the spring being attached to a screw on the shell or cage. There were other forms of it made, but this is the most common and it was regularly manufactured. The patent has now expired and the device is public property. This is the Horton clutch.

JAMES A. HORTON.

Providence, R. I.

Jig for Drilling a Circular Plate.

Editor American Machinist:

The sketches herewith show a jig for chucking and drilling a sheet-steel plate 3 inches in diameter and ⅛ inch thick. The holes were drilled 3-32 inch from edge of blank and had to be accurately spaced. Several thousand pieces were drilled with good results, although the stock was quite hard.

In Fig. 1, *A* is the blank to be drilled and *B* a split chuck which, being drawn down into sleeve *C* by lever F, holds the blank fast. Sleeve *C* is a good fit in casting *D* and carries an index and feed plate *E*, this plate being secured by the sleeve by means of set-screws *M*. At *H* is the index pin and directly back of this is the

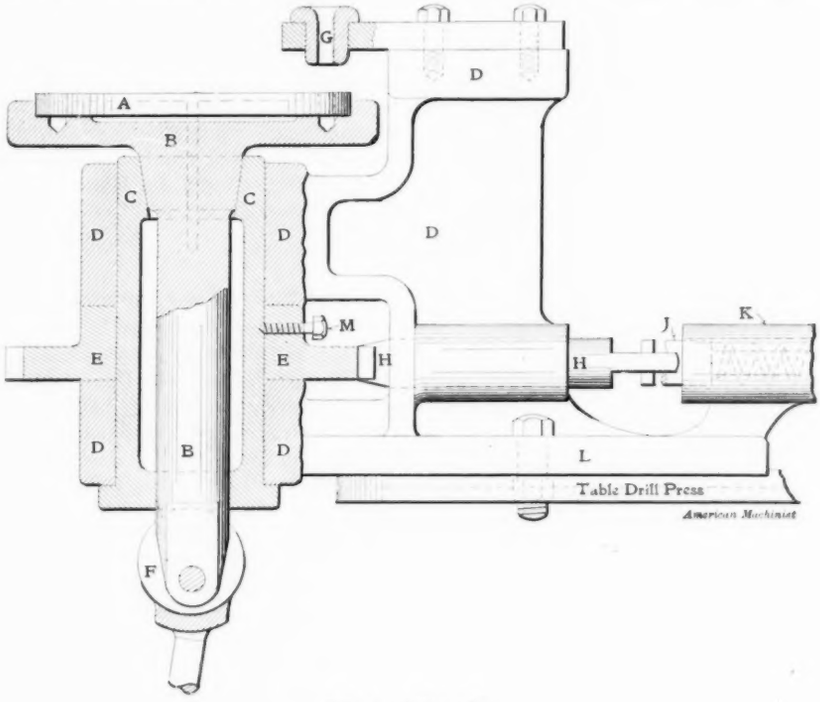


FIG. 1. DRILL JIG.

spring pin *J*. The operating lever is not shown in this view.

Fig. 2 shows the index and feed plate, and the manner in which the lever when moved to the left withdraws the index pin and turns the plate. As the handle

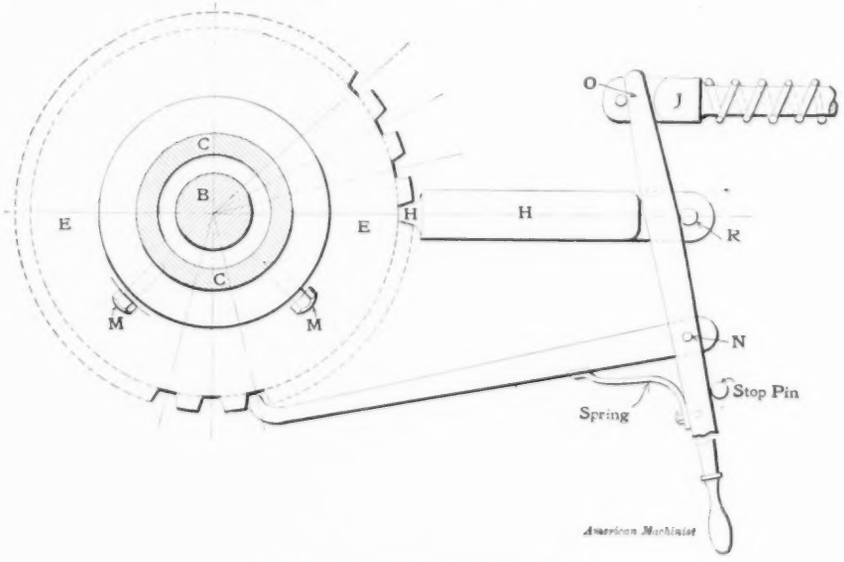


FIG. 2. INDEXING ARRANGEMENT.

is moved toward the plate, spring pin *J* is forced back and index pin *H* withdrawn. As *H* releases the plate, the pressure on the lever still being in the same direction, the plate turns until the index pin drops into the next notch.

CLEVELAND.

Rimer or Reamer?

Editor American Machinist:

A "non-Englisher" sometimes finds himself puzzled when dealing with Englishmen and Americans at the same time, for some very common words are pronounced differently by the two tribes. Thus a patent is a pa'tent in England, with the "a" as in "lake," but a pat'ent in America. The *Times* receives adver'tisements, but the AMERICAN MACHINIST advertise'ments. The English lever, pronounced leever, becomes a levver on the other side. This sort of thing is apt to occasionally place a non-Anglosaxon in an awkward position when he talks in his office with an American or an Englishman, as the case may be, and uses some

such word and the other repeats it with a quite different pronunciation, so that a sharp youth who happens to listen comes to believe that the boss has, after all, but an imperfect knowledge of the English language.

Now, I always feel aroused when seeing in an American journal the word "reamer," for I claim to know the descendence of the term "rimer," as this most popular tool is called in England, and this descendence, if actual, would show the form rimer, with the "i" as in "like," to be the only right one. When at last I heard the thing spelt reamer pronounced "rimmer" I felt sorry to find the original sense of a technical term thus effaced, and I consider any such effacement not such an utterly indifferent matter as some will think; it is, after all, a loss to the spirit of the language, which might as well be avoided.

Now, first of all, it is certain that the tool in question has been called a rimer in England for centuries and long before it came to America. But why rimer; what origin has this word? In all probability it is simply the German word *Raeumer*, pronounced roimer, which means room-maker—that is, extender, opener. The term, which is also contained in dictionaries, is used by practical men only in certain districts of Germany, and far more universal is the term *Reibahle*, which translates rubbing-awl, an awl by which a hole is "rubbed out." Possibly rimer may, by a process of consonant-conversion similar to the very frequent one between "b" and "v" and "f," be derived from *Reiber*, pronounced riber, an abbreviation of *Reibahle*, and translating rubber. It seems, however, far less artificial to assume that in former times the word *Raeumer* was more frequently used than it is now, and indeed I am in my speculation going so far back as the sixteenth century. It is known that Queen Elizabeth of England called into her realm German miners in great number in order to foster the mining industry, in which at that time Germany was foremost in Europe. Those foreign workmen of course brought their tools with them, and prominent among these were big rock drills and rimers, as they are up to this day. If now (the fact of which I am not in a position to establish) the immigrating miners were mostly taken from a High-Saxon or a kindred tribe, they will have pronounced the word *Raeumer* not roimer, but with a more open sound, somewhat like rimer. Considering further that at that time there were not many industries calling for similar tools, it does not appear at all unnatural that the English, when being instructed by the German miners, accepted from them the denomination of that special tool, from whence the term may have made its way into other trades. This granted, it would be proved that the English pronunciation of rimer is not only historically but also, what is essential, etymologically right. (I am quite prepared to be found mistaken in my derivation; the term rimer may have existed in England long before Queen Bess, and been imported by the Danes, or already by the Angles and Low-Saxons when these peoples made their raids; let somebody aid us who knows the respective languages.)

But what may have caused the American pronunciation (and consequent spelling)? Speculation on this point can only be vague. Maybe that, when trades were first started in the new English colonies, German immigrants held a good share of it; that they saw the English term for the well-known tool in print; that they pronounced it as they would a German word —*i. e.*, reemer—and that somehow this pronunciation spread. Or a quite different explanation: Some text book writer or catalog maker, possessed of a purist's mind, may have taken exception to a term suggesting a heterogene notion. What is a rimer? Spell it "rhymer" and it is a man who makes rhymes (although the proper word for this is rhymster!) and this, as a rule, is a very useless occupation. Why then should a very useful tool be thus stigmatized? "Surely," I hear the good man say, "it is not meant to be pronounced rimer at all but reamer, so let us also write it like that." And, as is the way with purists, he never stopped to think that reamer gave as little sense as a rimer without rhymes. Joking apart, one should not underestimate the damage done to logics and to the soul of a language by over-rationalism in cases of this nature. I might quote a good many instances in which there is quite a practical side to this question, and I have in mind at least one where the effect has impaired the world's commerce; but this forms a chapter of its own with which I would prefer to deal separately some day. In conclusion, I hope your readers, whether they will ream their holes, or rime or rimer them, will agree that my above theory is at least well rhymed.

Berlin, Germany. B. ESMARCH.

[Whatever may have been the origin of the word rimer or reamer, the latter means to-day in America a tool for slightly enlarging or smoothing a hole, just as much so as rimer or rhymer means the same thing in England. It is sometimes here pronounced rimmer, but usually as spelled—reamer—and it is extremely unlikely that any change in that practice will take place here for a long time, if ever. An account of the case in which varied pronunciation or spelling has retarded international trade would be of more practical interest.—Ed.]

More About "Good Enough."

Editor American Machinist:

At page 708 there appeared an editorial on "Good Enough," comprising extracts from *The Engineer*, of London, and comments thereon from the AMERICAN MACHINIST's standpoint. This subject is well worth pondering over by everyone, for its importance is far beyond what it at first appears, and means either dollars in or dollars out of pocket to shop managers.

Our friend Tecumseh Swift, in an article on another topic in the same issue, wrote: "The real question is not how good a job can be done, but how good is good enough."

The basis of the correct good enough is, in my opinion, found to be common sense, but this is modified by early shop education. Shop requirements are so drilled into the boys' minds that they stick to them throughout their lives.

Some years ago there worked in our shop an old man, one of the fine old stock, who always finished his work in the highest style, but he would make the corners of his work sharp where he had been repeatedly told to round or chamfer them. In excusing himself he would tell how, when learning his trade, his old boss had threatened to discharge him if he did not make his corners square and sharp, and this had become second nature to the old gentleman, and to him his old boss word was still law. Nowadays we know better and have all edges rounded, except at fitted places and cutting edges.

From observation and personal contact with boys of all ages and of various degrees of intelligence, one soon learns that mechanics are born and seldom made, either by working at the trade in the shop or attending manual training schools and colleges. Good common sense is the thing most needed after mechanical ability. It is a natural endowment, the same as tact or good looks, and is sometimes called good judgment.

Some workmen are so desirous of doing a beautiful job that they will spend much valuable time in polishing surfaces that later on will be hardened and ground, or perhaps make a bearing anything but round and straight in getting out a little scratch. The workman who finishes his work closest to size mechanically and uses his file the least is generally the one to rely on to do the most and best work.

In regard to making dimensions, whether to absolute standard or not, is a nice test for one's common sense, especially when full instructions are not given. An order may come in for a 4-inch ball for a flagstaff; how absurd it would be to use the "mike" to get it exactly to the size specified.

H. E. B.

The Ideal Manufacturing Company, of Chicago, have adopted the plan of printing on the back of their business cards tables that are useful to shop men; one they send us having a table giving useful particulars about steel stampings, such as are made from cold rolled sheet steel.

Necessity is the mother of invention, but it is a wise invention that provides for its own father.—*Ohio State Journal.*

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The Metric System in the Manufacturers' Association.

Again we are reminded of the old fable about the knights and the bi-chromatic shield by the discussion of the metric system which we find in the recently received report of the proceedings of the National Association of Manufacturers at their meeting in Indianapolis. It is here again shown very clearly that those who advocate and those who oppose the adoption of the metric system generally fail to understand each other; and the points in which misunderstanding exists are best shown perhaps in the remarks of our Mr. F. A. Halsey in opposition to the proposed measure and to the metric system generally.

In his address on the subject Mr. Halsey assumed that the passage of the bill then pending in Congress, or at least the adoption of the metric system, would mean the throwing away of all our present standards in machine construction and the things made to those standards, and said: "The gas pipes in the ceilings of our homes will keep the old system alive fifty years at least. If this bill is made compulsory the mere necessities of the case will keep the old system alive fifty years. If you want to put a new tip on the end of your chandelier, if they are made to the metric system there isn't a chandelier in the country that will take them. There isn't a pipe in the United States that will take the French thread. Are we asked to tear out our gas pipes, water pipes, steam-heating pipes to satisfy this fad? We don't appreciate what our blessings are when we talk about changing to this thing." Mr. Halsey rang the changes on this idea through line shafting, pulleys, hose couplings, etc., finally seeming to make it appear that our system of interchangeability of parts was somehow inseparably bound up with the inch and the binary subdivisions thereof, and finally drawing an awe-inspiring picture of our lamentable condition when we shall have been forced to the adoption of the metric system.

Now the simple and apparently sufficient answer to all this is to be found where perhaps we should least expect to find it, and that is in the remarks of machine builders, who at the same meeting also opposed the bill, and in doing so related what had been found necessary to be done in order to do business with metric countries, *i. e.*, they simply got out catalogs with such dimensions as were given stated in metric terms, and the only changes they made in the machines themselves were in the pitch of traversing or lead screws and the graduations thereon, if any; not a reamer, or a gage, or a tap, or a jig, or a milling fixture used in the production of these machines was changed in the least, nor was any dimension of the machines altered; yet they filled all the requirements in the metric-using countries to which they were and are still being sent.

Now, if these machines so made meet the requirements in other metric-using countries, why would they not do the same thing here, and why would it be necessary for us to throw all our standards away if we adopt the metric system? Obviously it would not be necessary.

No one who has candidly looked at the matter will for a moment imagine that if we adopt the metric system of measurement we shall be obliged to throw away the Briggs standard of pipe threads, or that the Morse taper shanks will become useless. Well-informed people know that the Morse taper shanks, instead of being ⅝ inch to the foot, as they were intended to be, are, most of them, something else, the variation being due to the fact that they were adopted before exact methods of measurement were known. They are perpetuated because, practically, they must be and gages permit their reproduction as surely and satisfactorily as though they were precisely ⅝ inch to the foot instead of being an approximation. These same gages and others like them will go on performing their functions as long as taper shank tools are used in machine shops and the men who make them will know little and care less whether their actual sizes are designated (on the rare occasions when they are mentioned at all) in decimals of an inch per foot, as at present, or in decimally expressed metric quantities, as they might sometimes be required to be if the proposed law were enacted. So it would be with every other gage or fixture. Nor will anyone be asked to pull down his house because the bricks of which it is composed are 2″ x 4″ x 8″ instead of being made to metric dimensions.

We should entirely disabuse our minds of the idea that the adoption of the metric system will compel anyone to make a journal or gear or any part of a machine to a certain dimension. Comparatively few parts of machines are made to precise, even, inch dimensions. The designer or builder makes them the size he wants them to be, usually having to express their actual size in decimals of an inch if the work is close and made interchangeable. He will go on doing precisely the same thing after the adoption of the metric system, except that he will express the minute measurements usually necessary to fulfill the requirements of interchangeable work in different but generally more convenient terms, the work itself, if he desires to have it so, remaining the same size as before.

In the meantime, irrespective of the merits or demerits of the metric system—whether it is a "fad" or a "mere bagatelle," as Mr. Halsey describes it, or whether it is a reform of vast importance, as its friends maintain—it will save a lot of time for all concerned and be a great economy of printers' ink if the metrophobists and the pro-metrics would endeavor to get together sufficiently at

least so that each side can understand what the other is talking about and what it is that is proposed to be done.

An English View of the American Love of Money.

The commission appointed by the British Iron Trade Association to inquire into the iron, steel and allied industries of the United States has made its report, and in it some opinions are expressed regarding the real significance of the American chase after "The Almighty Dollar" which are decidedly at variance with those commonly held abroad. Of these opinions, perhaps the most significant is that of Mr. Sahlin. The report in question is by an English commission and is an English publication, but nevertheless it is scarcely correct to call Mr. Sahlin's opinion an English one, as he is of Swedish birth and lived for several years in this country, where, with a knowledge of the American people, he acquired also a knowledge of American blast-furnace methods which he is now applying in England. His American experience forms, of course, the basis of his opinions, from which we quote as follows:

"In America, the personal factor in iron making is recognized as to be fully as important as that of plant. It is not the guns which win the battle, but the men who stand behind them. A good weapon, poorly aimed, is not dangerous, but neither will it do to arm good fighters with obsolete guns. In the above report I have tried to show that the guns—that is, the plants—are splendidly and powerfully equipped, that raw materials are plentiful and good, and that the system of transportation and handling is unexcelled. In this chapter I wish to speak of the men as I have learned to know them during twenty years of association. . . . I have often heard it erroneously stated that the Americans worship dollars. This is not so, because a rich man as such is not greatly esteemed. What the American admires and honors is the ability to do; that capacity in a man, through his own sagacity, nerve, enterprise and skill to create and employ a fortune. Nobody in America seems to feel above his work or to be degraded by it. As it is done, and as is the result obtained, so is the man esteemed by his fellow-men, and such is the place he will make for himself in his community or in his country. Everybody works, and works for the sake of work; and thus there has been produced in America in the short space of one generation an industrial potentiality which is more wonderful and more to be feared than the works and plants which these same workers have created. Nowhere is the struggling youth more kindly encouraged, more readily trusted, more generously aided, more gladly made place for, than in America, and when I say this I speak from personal experience, and with gratitude in my heart toward many of those busy and keen, but also generous and broad-minded American men of affairs."

This is certainly a generous view of us and for this reason we may be unduly influenced to consider it a true one. We do believe, however, that it is well justified by the use which Americans make of money after acquiring it—by the way in which they spend it, scrap out-of-date machinery which represents it and give it away for public and semi-public uses to a degree that is unapproached elsewhere. Nowhere else, we believe, do families of great and of little wealth associate on such terms of absolute equality, and nowhere else is so little seen of that most sordid use of money—marriage settlements.

The average Englishman noting the devotion of the average American to his business ascribes it, not unnaturally, to a simple thirst for money. We are far from contending that this is not a large factor in the situation, but it is nevertheless, we think, true that the American has learned, to a degree that Englishmen have not, the genuine pleasure there is in doing something—the real satisfaction there is in making the "wheels go round." The Englishman looks upon his business as a means of supporting his pleasures and his sports, the American as a worthy object of his best efforts.

We may all admire a great soldier without attributing to him a delight in killing his fellow-men. The immediate aim of war is to kill your enemies and the immediate object of business is to make money, but behind both are greater aims, and a captain of industry, no less than a leader of armies, may have his eye set upon the greater object while industriously pursuing the lesser. As Mr. Sahlin puts it, "what the American admires and honors is the ability to do"—a statement that could find no better illustration than the case of Mr. Schwab. While his income may be a source of personal envy, it is not this that makes him the leading and honored figure he is to-day, but rather his "ability to do"—the fact that by his own efforts and capacity he has forced himself from humble station to his present position. If there is anything in this country which is equivalent to a patent of nobility abroad it is the situation of a "self-made man" who has not "knocked off work too soon and commenced braggin' 'bout de job."

Whatever the small and insignificant set which is commonly called "the four hundred" may think, there can be no doubt of the comparative estimation in which the American people hold the Astors and Mr. Carnegie. How their wealth compares we do not know nor care, but the fact that the former inherited it while the latter made it grades the two in a manner which demonstrates that in honoring what is called success," Americans do not doff their hats to the money which is its outward manifestation, but rather to the "ability to do" which is its inner sign and seal.

Automatic.

Permit us, gentle reader, to speak a word in behalf of the word "automatic." This word is being shamefully misused by writers on mechanical subjects and by builders of tools and machinery, and it is time, we think, to put a stop to it. Automatic means just one thing, and one thing only, *i. e.*, self-acting. A lathe that has feeds that work by power has automatic feeds, but the lathe itself is not automatic unless it puts in and takes out the work, starts the cuts and ends them, and in short does all the things that the lathesman is hired to do. We find in the columns of an esteemed contemporary a description of a chuck for a turret machine, which chuck is described and referred to as automatic, though it is perfectly clear that the work must be put into it and taken out by hand and that the operator must also, by some means not clearly indicated, open and close the chuck. By what right is such a chuck automatic, we should like to know. This error of naming things automatic that were not really so has in some instances compelled the use of such abominations as "full-automatic" or "completely automatic" in order to designate machines subsequently designed and which approached more nearly to being really automatic, and we respectfully submit that machinists, who of all others are such sticklers for exactness and precision, should exercise their love of such qualities when they are choosing descriptive words. This would not only be more consistent, but it would be the means of avoiding some confusion, which, if the present loose practice is continued, seems likely to end in utter chaos, so far as the application of this honest and entirely proper word to things mechanical is concerned.

The Alleged French Steel Swindle.

Editor American Machinist:

At page 998 you give a warning to purchasers of French steel, but I think it hardly strong enough. I send you a bill from one of the French houses that has been selling steel in this field under peculiar conditions. The method of the representative was the same in all cases; that is, after showing the fracture of a $\frac{3}{8}$ square bar Tungsten steel and $\frac{3}{8}$ octagon Chrome steel, he would solicit an order for a short trial bar, then writing the order in French would get the signature of the party. In the case of bill of J. A. C., the order should not have been over $10, including duty, as represented to the purchaser. You see there is a large increase of the amount. What the J. A. C. Co. would like to know is, if they can be compelled to pay for any amount in excess of what they supposed they ordered. You are at liberty to publish any part of this you may wish, as it may serve to stop this method of doing business. The steel is not nearly as good as some American specials. I gave them some samples from two do-

mestic makers that were superior in fracture, as a result of which they lost interest in trying to sell to me.

Providence, R. I. GEO. HAMILTON.

[The bill of the J. A. C. Co. is for 452.83 francs, or about $90. Probably the workers of this game count upon the bills being paid "to save trouble." It is doubtful if the amount could be collected, especially if the steel is promptly placed at the disposal of the sellers. As to warnings of this kind, our friends should remember that an editor must be pretty careful if he would avoid doing an injustice to innocent people. A hint to the wise ought to be sufficient, and when one knows that queer things are being done he can then be on his guard and use caution in dealing with strangers.—Ed.]

The Worcester Strike Declared Off.

The Worcester machinists' strike was formally declared off at a special meeting of the union on Wednesday night. This action was decided by a four-fifths vote of the men actually on strike. This strike, lasting a little more than seven weeks, is admitted by the labor leaders to be a failure, and the total number of machinists involved was about 360.

One of the results has been the bringing into Worcester of more than 100 new competitors in the labor market. At the shops of F. E. Reed Company 250 men are now at work, and by next week the full complement is expected to be engaged. At Prentice Bros. the ranks are somewhat thinner, but the company are hopeful of getting into full swing shortly. This company makes complaint that another concern (member of the Metal Trades Association) has violated the rules of the organization and has engaged a number of their best men during the strike. O.

Worcester, July 12.

A Useful Autocar Test.

The Automobile Club of Great Britain is promoting an endurance run which may tend to show an intending purchaser what builder offers most for the money. In this the cars, instead of being classified according to their motive power as is usually the case, are classed according to price, without regard to make, power, weight or carrying capacity. There are eleven classes in the first of which the price is $750 and in the last over $6,000. The test will be held over a course of 650 miles, and will occupy six days. Points will be scored for reliability, hill climbing, speed, steering, and braking qualities and condition at end of route.

Don't put small reference letters on the drawing and capitals in the manuscript, nor *vice versa*. The fact that a great many contributors do it more or less does not make the trick any more enjoyable. It's one of the things one has to wonder at and make unprintable remarks about, and then go and make changes all through.

Some New Things.

A NEW VISE.

The illustrations show a new vise for milling machines, planers, shapers and drill presses. The half-tone, Fig. 1, gives a good idea of the general appearance of the vise, and the construction is clearly

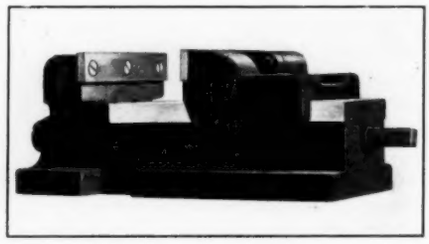


FIG. 1. A NEW VISE.

shown in the sectional view, Fig. 2. The body of the vise is cored out from the bottom and two long narrow slots are formed in the top. Through these slots run two links that connect the sliding jaw to the nut inside the base. This nut rests against the under side of the casting and is always in advance of the sliding jaw as shown. When a piece of work is being gripped the nut draws the sliding jaw and the nut

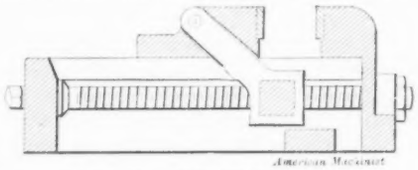
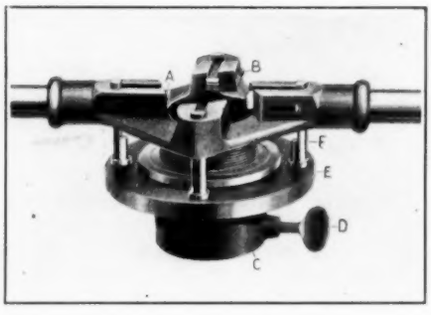


FIG. 2. SECTIONAL VIEW.

down tight on the base. This vise is made by the Hill Tool Company, Anderson, Indiana.

PIPE STOCK.

The accompanying half-tone shows a new pipe stock brought out by Wm. W. Vosper, of 222 Vine street, Sandusky, Ohio. This stock has four slots in front and in these slots fit freely the chasers *A*. The end of a small pin *B*, held by a flat



PIPE STOCK.

spring, enters a countersink in the side of each chaser and keeps it in place. At the back of the stock is a sleeve *C* which is fastened to the pipe to be threaded by the screw *D*. The front end of the sleeve is threaded and acts as a lead screw to draw the stock and the chaser on to the work. A ring *E*, fitting freely in the sleeve, carries four pins *F* which are milled off at an angle as shown. These pins pass through the stock and form guides against which the chasers are forced as they are drawn up on the pipe. Thus the required taper is given to the thread, and the chasers moving outward as they slide along the pins, they have a free cutting action and do not bind on the thread. In backing off, the ring *E* is moved slightly ahead, loosening the chasers and allowing them to clear the thread as they run back. The design of the stock is such that lubricant is readily applied to the cutting edges, and the work is always in sight.

SEMI-AUTOMATIC FRICTION PULLEY.

The cuts show a friction pulley made by the Hawkins Manufacturing Company,

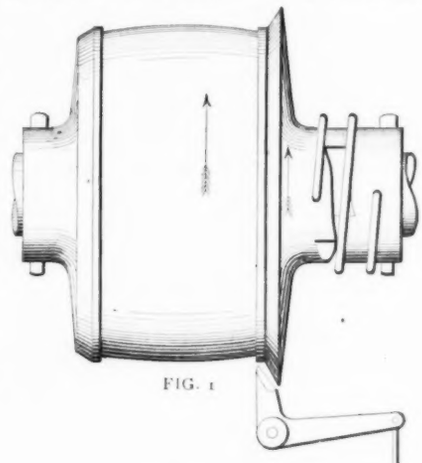


FIG. 1

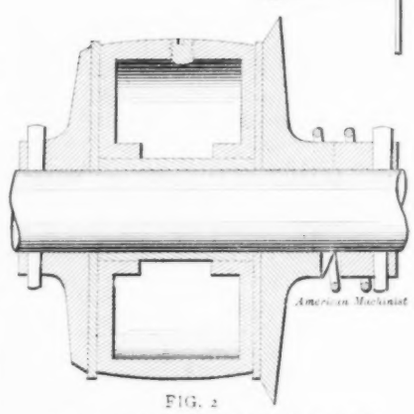


FIG. 2

SEMI-AUTOMATIC FRICTION PULLEY.

591 Atlantic avenue, Boston, Mass. The pulley runs freely on the shaft between two flanges faced with leather to form friction surfaces. The flange at the left is fast on the shaft, while the flange at the right is loose. On the end of the hub of the latter flange teeth are cut, the surfaces between the teeth being helical, as shown in Fig. 1. The fixed collar at the right is milled to correspond. The spring secured to the loose flange and the collar is always under tension and tends to rotate the flange in the direction in which the belt travels. As the flange turns on the shaft it is, of course, forced against the running pulley and is then turned by the friction until the pulley is clamped fast

between the two friction surfaces, when the pulley, flanges and shaft all rotate together. To release the pulley, the brake—shown just below the right-hand friction disk—is brought against the angular face of the flange. This holds the flange back, but the collar still turns ahead with the shaft, thus removing the end pressure on the friction and releasing the pulley. This pulley is self-oiling, the oil chamber being shown in the sectional view, Fig. 2.

Technical Publications.

"The Cost of Production." By C. J. Watts. 64 5¼x7¾-inch pages, with 20 illustrations. The Shaw-Walker Company, Muskegon, Mich.

The system of cost accounting described in this pamphlet is used in an agricultural implement factory. To how great an extent it could be used in other lines of work involving different conditions must be judged by those having the conditions to meet, but in one particular the pamphlet is of wide interest, even supposing that the system as described could not be used at all. We refer to its explanations and illustrations of the use of the card file in connection with cost accounting. It is in this respect the most complete publication which we have seen. All those who desire to acquaint themselves with the wide usefulness of this appliance will find the publication extremely useful, even though they do not make use of a single feature of the cost system described. The cost of the pamphlet is not given, but we assume that it is intended for free distribution to interested parties.

"Steam Heating and Ventilation." By W. S. Monroe. 150 6x9-inch pages with 89 illustrations. The *Engineering Record*, New York. Price, $2.

A number of books have been made up from time to time from articles published in the *Engineering Record*, and the present volume is an addition to the number. It discusses most of the problems which come up in the design of steam-heating apparatus, including those systems in which ventilation is accomplished along with heating. In this connection we notice that more space is given than is usual in works of this class to the avoidance of drafts, and especially to the distribution of the air, which the author states he considers is even more important than its volume. The element of judgment enters largely into this class of work as a matter of necessity, but in the present volume definite rules, formulas and diagrams are given for a great variety of the problems to be considered. In some cases the rules and constants of different authorities are given together for purposes of comparison.

We would like the full name and address of the correspondent who signs himself "Mike Lunkhed."

We have received a copy of the annual statistical report of the American Iron and Steel Association, 261 South Fourth street, Philadelphia, containing figures for the American and foreign iron trades for 1901. Besides iron and steel, coal, coke, shipbuilding, etc., are given some attention.

We have previously noted that Congress had authorized the building of one of the new battleships at a navy yard. It did not specify which yard, but the Secretary of the Navy has, since that time, decided to have the vessel constructed at the New York Navy Yard. Strong influence was brought to bear to have the vessel built either at Boston or at Norfolk, but it is understood that Boston was not chosen because it would have required two years to have brought the equipment up to the point of being ready to construct such a vessel, while in the case of Norfolk the additional freight charges to the navy yard would have been considerable. It is understood that the freight rates to that point are about 10 per cent. higher than to the New York yard.

Personal.

C. H. Norton, of the Norton Grinding Machine Company, Worcester, sailed July 9 for Southampton, and will be gone about six weeks.

H. A. Bugie, of the New York steel house D. G. Gautier & Co. and the Philadelphia Forge Company, sailed, July 15, on the "Kaiser Wilhelm der Grosse" to be gone about two months.

The Lyman C. Smith College of Engineering at the Syracuse (N. Y.) University will have a faculty of about ten instructors, the list being now practically complete. We have already mentioned the appointment of Prof. Chas. L. Griffin, hitherto of the Pennsylvania State College to the chair of mechanical engineering. It may be added that Messrs. Tolle, of the State college, and Shepard, of the Annapolis Naval Academy, have been engaged as associate professors at the Smith.

Obituary.

William Fraser Garrison, senior partner of the firm of Guild & Garrison, of Brooklyn, N. Y., steam pump manufacturers, died at his summer residence, Morristown, N. J., July 8, sixty-nine years old. Mr. Garrison was a native of Brooklyn; he learned the machinist trade while quite young and was one of the earliest inventors of the direct-acting steam pump with steam assisted valve. It is understood that the firm of which he was later the head was formed when he was scarcely of age, and he remained in the same business all his life.

George Thomas Crook, formerly Inspector of Machinery in the British Navy, and known throughout the service as "the man who sat on the safety valve," died recently at Rochester, England, seventy-two years old. In the Egyptian War of 1882 he had to do with the hoisting of two locomotives urgently needed for the Egyptian Railway. The cranes available were not of sufficient power to lift them with the usual steam pressure, and he added his weight to the safety valve, of course at the risk of his life, and raised the pressure sufficiently to make them effective for the emergency.

Commercial Review.

NEW YORK, Monday, July 14.

OPINIONS ON THE STATE OF TRADE.

We have within the past week obtained by letter the opinions of a number of machine-tool manufacturers, etc., on the state of trade, and let them speak for themselves below. It will be noticed that in every case the tone assumed is buoyant, which augurs well for the present and future of business:

Hill, Clarke & Co. write from Boston: "All of the manufacturers of machine tools whom we represent are very busy, with orders enough ahead to keep the shops running for two or three months. Our own business at the selling end has been really very quiet at this, the Boston office, since about the first of May. At our New York office business has been steadily improving. The new machines that we are introducing are selling very rapidly. Business at our Chicago office continues on a high level as regards sales and has been very much better since the first of June than we anticipated. We are inclined to think that, as a rule, business among the machine-tool manufacturers all over the country is very satisfactory."

The Newton Machine Tool Works, Philadelphia, write: "We are pleased to advise you that business with us is exceptionally good; we are crowded with orders, and the outlook for the future is very bright, and we look forward to prosperous business for some time to come. The only weak point in our business at the present time is the lack of foreign orders, and while foreign business has been depressed for some time we are pleased to state that it is now looking more hopeful."

A company which builds plate working and other heavy metal-working machinery writes: "Inquiry in our line keeps up at a good pace and we are perfectly satisfied with the outlook for the immediate future. The railroads are especially heavy buyers at this time."

The Norton Emery Wheel Company, Worcester, Mass., write: "Our business in machinery has been first-class during the present year, and the prospects to us seem very bright. We are receiving more and more business all the time in both the machine and emery-wheel departments, and we have never known a time when it seemed any livelier."

Flather & Co. (Inc.), machine tools,

Nashua, N. H., write: "The volume of business with us at present is very good and greater than our present capacity. Our orders for the last six or seven months are one-third more than the average in previous busy times. We are enlarging our equipment to meet the demands."

The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, write: "Not long ago we purchased four acres of property adjoining our original plant and have just completed additions which give us 36,000 square feet of floor space more. Business has continued to flow in a steadily increasing volume. We confidently look for a continued solid good business."

J. E. Snyder, manufacturer of vertical drilling machinery, Worcester, has written as follows: "We have added the following new tools to our plant the past few weeks: One Brown & Sharpe No. 16 grinding machine, one Binsse horizontal boring mill, one Rogers & Hemphill upright boring mill, one Walker cutter grinder, one F. E. Reed 18-inch lathe, one 14-inch Reed toolroom lathe; also full set of Rogers adjustable reamers, also full set of Brown & Sharpe limit gages. We have also increased our working force about one-third. We are exceptionally busy for for this season of the year."

We understand that the American Tool and Machine Company, Boston, Mass., requires more power to meet the demands of business. The engine and boiler rooms are being enlarged for the installation of three new boilers and a new 300 horsepower engine made by the Rollins Engine Company, of Nashua, N. H. At the same time new dynamos will be installed for increased electrical purposes.

The scarcity of pig iron has resulted in Scotch coming into the market quite largely to take the place of domestic soft grades. The hard grades are being bought in Germany to some extent, though they are not obtainable there with unlimited ease.

As an outcome of negotiations between the Sprague Electric Company and the General Electric Company looking toward the purchase of the former by the latter, John Markle, president of the Sprague Company, has notified the bond and stockholders of a contract he has made with the General Electric Company. It provides that if two-thirds of the bonds and two-thirds of the stock of the Sprague Electric Company be deposited prior to October 1, the General Electric Company will take them on a certain basis of purchase and exchange. It is proposed to use securities of the Otis Elevator Company as the medium of exchange in part.

The Nordberg Manufacturing Company, of Milwaukee, has the contract to build for the Champion Mine, in Houghton county, Mich., an air compressor which will have a capacity for handling 100 drills.

It is rumored that the Pedrick & Ayer Company, of Philadelphia, is to establish a plant at Plainfield, N. J., to build principally hydraulic machinery.

Failures in the line of machinery and tool manufacture, as reported by Dun for the second quarter of 1902, were 37, with $475,803 liabilities, in comparison with 33 and liabilities of $450,323 in the second quarter of 1901.

The Illinois Glass Company has recently purchased an electrical equipment from the Westinghouse Electric & Manufacturing Company. It will be used for the operation of the machine, blacksmith and mold shops, blowers, etc., and includes a 250-kilowatt, two-phase, 440-volt, 60-cycle belted generator; twenty Type C induction motors, thirty-eight Type O. D. transformers, and arc and incandescent lamps.

Unusually good demand is reported for the White Star oil filter manufactured by the Pittsburgh Gage & Supply Company, Pittsburgh, Pa.

The Treasury Department has handed down a decision relating to the application of Justice & Co., of Philadelphia, for a drawback on the export of hydraulic jacks. In the case of such jacks, made in part from imported steel tubing, on which a duty of 35 per cent. *ad valorem* has been paid, a drawback will be allowed on seamless steel tubing less the legal deduction of one piece. The drawback entry must show the marks and the numbers of shipping packages, the number and size of the jacks therein and the number of pounds of tubing used in manufacturing. It was here ruled that there must also be a statement that the goods were manufactured in the manner set forth in the manufacturer's sworn statement, dated April 22, 1902. In liquidating the entries a sworn statement of the amount of imported tubing used in the manufacture of 10, 15, 20 and 30 ton jacks must be filed with the entry.

THE RUSSIAN TARIFF MUDDLE.

The letter published below is self-explanatory. It shows how our tariff chickens are coming home to roost. We do not offer the communication as presenting anything very novel. Testimony of the same sort has been published over and over again.

"VLADIVOSTOK (Eastern Siberia),
12 May, 1902.

"The Niles Tool Works Company,
Hamilton, Ohio.

"Gentlemen: Referring to the correspondence I had with your esteemed firm, December, 1900, from San Francisco, about coming out here to Siberia and Mandshuria in interest of American trade, I have now to report the following:

"After traveling extensively since I left San Francisco I arrived here a few weeks ago and found employment, but the outlook for American machinery is at present rather gloomy, and that wholly for reasons chargeable to the American debit. For, as you have probably noted, the Czar's government has, in answer to the American duty on Russian sugar, levied a differential duty of nearly 10 *cop* (5 cents) a pound, or $100 a ton, on all American machinery except that below noted.* This duty is still in force, successfully shutting out most of otherwise very salable American machinery, as sawmills, flour-mills, copper, silver, iron and coal mining machinery, tools and apparatus of all kinds and countless other things.

"But this little circumstance does not seem to worry the local American importers in the least, for they rather prefer to deal with English and German firms, claiming that they receive prompter and more reliable service from European houses than from their own countrymen, who, they say, pay but little attention to the accurate execution of orders, and still less to the proper and careful packing of goods—a thing very essential to the safe delivery of all classes of goods, but especially so in case of machinery.

"As English and German manufacturers and importers are very diligently taking advantage of the present condition of things, and as the Russians are a very conservative people—very slow to change when once used to English and German goods—it is certainly high time for American engine builders and iron goods exporters to take a hand in the sugar game as otherwise they are in danger of losing the market in this part of the world for a long time to come.

"On the other hand, American machinery is, on its own merits, entirely capable of crowding the English and German product out of the market, if only American exporters would act properly in protection of their own interests.

"Yours truly,
"A. F. BROWN.

"Care of Clarkson & Co.,
Vladivostok, Eastern Siberia."

CHICAGO MACHINERY MARKET.

For a new shop which they are erecting near Chicago, C. H. Besly & Co. sought one day last week to purchase some 2 15-16 inch shafting. They could find none in all Chicago, nor could they find a seller who would guarantee early delivery of the same. A little further inquiry by the writer brought out the statement from a large producer of shafting that all the large round bars which will be produced during the remainder of the year have been sold, though the smaller merchantable products of the mills are not so scarce. The large mills have been overtaxed by the unusually large calls for heavy machinery and other work of uncommon proportions.

Shop activities are not decreasing quite to the ordinary extent in July, owing to the heavy demands for the product of the shops. The railroads figure conspicuously in this activity. A local car works has booked enough orders to keep the plant in

*Of this differential are excepted: Agricultural machinery (except locomobiles), gold mining machinery, railroad locomotives and cars, pianos, scales and a few smaller things.

full operation for the next twelve months. They are turning out more product than anticipated, adding constantly to their capacity, but there is said to be not a Western railroad system that is not in need of additional equipment and the car works are buying quite a heavy supplementary tonnage of material.

The agricultural implement makers also are just now very busily engaged in buying material for the coming season. They are contracting on a large scale and their plants are still in operation. The same degree of uninterrupted manufacture is encountered in various other branches of the metal-working plants. There are, however, some shops that have closed for a few weeks for inventory, for repairs or for the inactive season of midsummer. This is making the store trade for machinists' supplies somewhat less than it was a month or two ago. One large seller of supplies says the regular summer decrease of about 25 per cent. has come. That is the extremest view of a decline that has been met with, but, as compared with May, there is undoubtedly a decrease in the store trade.

One very encouraging sign is that the representatives of some toolmakers who found trade quiet a month ago say it has improved vastly during the past thirty days. They do not sell to the consumer direct, but to stores and to jobbers. A month ago, anticipating the usual summer lull, these buyers did not order freely. They are now asking for their autumn requirements, which from all indications will be very heavy.

The Chicago office of the Norton Emery Wheel Company has just received from the factory one of the largest solid emery wheels ever made. It is 5 feet in diameter with 30-inch hole, is 10 inches wide and weighs over 1,900 pounds. It is the duplicate of several wheels shipped on an order to Europe.

Quotations.

NEW YORK, Monday, July 14.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$21 15 @ $22 65
No. 2 X	20 65 @ 22 15
No. 2 plain	20 65 @ 21 65
Gray forge	20 15 @ 21 15

Alabama Pig, New York delivery:

No. 1 foundry, or soft	22 25 @ 22 75
No. 2 foundry, or soft	21 75 @ 22 25
No. 3 foundry	21 25 @ 21 75
Foundry forge, or No. 4	20 25 @ 20 75

As has previously been the case, even the highest prices above named are far from maximum. An advance in freights from the South is apprehended, which causes some hesitation in the acceptance of orders.

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93c. upward in carload lots. Smaller quantities from store, 2.15c. upward.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—The discount was diminished somewhat and prices may now be quoted at 2.75 @ 2.90c. from store for base sizes.

Copper—Lake Superior ingot, about 12¼c.; electrolytic and casting, 12c.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, 28½ @ 28¾c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—New York delivery, 5⅛ @ 5¼c., reported to be advancing.

Antimony—Cookson's, 10 @ 10½c.; Hallett's and U. S., 8 @ 8¼c.

Lard Oil—Prime City, 85½ @ 89c., according to brand and quantity ranging from one barrel up to large lots.

Manufacturers.

Frank Chase, Waterville, Me., is preparing to build a woolen mill.

The machine shop of N. D. Stanley, Essex Junction, Vt., has been burned.

Walker Bros., Viola, Ore., have decided to put in a water power sawmill.

The Smeeth Copper & Bronze Company, Chicago, Ill., will erect a plant.

Fire has destroyed the plant of the Lakeside Shoe Company, Burlington, Vt.

The Kruse & Bahlman Hardware Company, Cincinnati, O., is to build a large plant.

The Atlas Glass Company, Washington, Pa., is doubling the capacity of its plant.

Fire has destroyed the large plant of the Galion Wagon & Gear Company, Galion, O.

The plant of the Clark Textile Company, Sidney, N. Y., knit gloves, will be enlarged.

The Illinois Molding Company, Chicago, Ill., is about to erect a plant to cost $50,000.

The W. B. Earthman Lumber Company is preparing to put in a sawmill at Dickson, Tenn.

It is reported that the car shops of the Louisville & Nashville at Decatur, Ala., will be doubled.

S. Barber will erect a sawmill east of Bonners Ferry, Ida. A. J. Kent is his representative there.

The Bigelow Carpet Company, of Clinton and Lowell, Mass., thinks of erecting a new building at Lowell.

The Williams Brothers Company, of Manton, Mich., has decided to build a last block factory at Cadillac.

W. P. Symons has been reported at Centralia, Wash., looking for a site to establish a complete machine shop.

Shuttler & Hotz, Chicago, Ill., are constructing, at a cost of $250,000, a plant for the manufacture of wagons.

The Hope Mills Manufacturing Company, Fayetteville, N. C., will erect a $250,000 bleaching and spinning mill.

The Tuttle Press Company, of Elgin, Ill., printer and manufacturer of presses, will move its plant to Appleton, Wis.

Pratt & Lambert, varnish makers, Long Island City, N. Y., are about to put up a one-story factory building, 75x48 feet.

The Robertson Paper Company, of Bellows Fal's, Vt., will this summer put in a pulp mill and later may build a paper mill.

The Winona Mill of the Columbia Hosiery Company, 1955 Park avenue, New York city, will locate a plant in New Haven, Conn.

The Cutler-Hammer Manufacturing Company, electrical goods, Milwaukee, Wis., is considering the enlargement of its plant.

W. J. Dean, president of Dean & Co., Minneapolis, Minn., agricultural implements, has bought land for a new implement factory.

The cheese box factory and sawmill of Reinhart L. Fromme, at Howard's Grove, Sheboygan County, Wis., has been burned.

The Elgin National Watch Company, Chicago, Ill., has made plans for an enlargement of its plant at Elgin, Ill., at a cost of $250,000.

The contract has been let for the erection of a $32,000 factory building at Harrison, N. J., for the Edison General Electric Company.

An ordnance has been passed authorizing the City Council of Brigham City, Utah, to construct at once a municipal electric lighting plant.

A handle factory is being established at Dickson, Tenn., by a Louisville (Ky.) company. The plant will be managed by S. H. Harned, of Dickson.

The Bay Counties Power Company, of San Francisco, Cal., is building a sub-station below Oroville, and will have a machine shop in connection therewith.

The Brunswick-Balke-Collender Company, Chicago, Ill., manufacturer of billiard tables, will make an addition which will cost, including equipment, $200,000.

The Delaware & Hudson shops at Oneonta, N. Y., are to be enlarged. A new machine shop, steam heating and power station and an electric light plant have been decided upon.

The Capital Light & Power Company has been incorporated, to build a power-house near Macho canyon with a direct line into Santa Fe, N. M. Six thousand horse-power will be developed.

The Pittsburg Plate Glass Company, a large consumer of gypsum stucco, will enter the manufacture of same, erecting mills for that purpose. The formation of the plaster trust has occasioned this.

The blacksmith shop, machine shop, oil house, main offices, four box cars, together with valuable machinery in the Canadian Pacific Railroad car shops in Perth, Ont., have been destroyed by fire.

B. F. Nelson, of Minneapolis, Minn., and several lumbermen from various places have decided to build a sawmill at Virginia, on the Mesaba range. The investment in the mill alone will probably reach $100,000.

Arrangements are completed for the erection in Toledo, O., of a plant to manufacture steel castings. It will be known as the Ohio Solid Steel Company. Three hundred and fifty men will be employed at the beginning.

The Kellar chair factory, Marion, Ind., was seriously damaged by fire; loss, $25,000. The fire originated in the dry kiln and spread to the east wing of the building, destroying the machinery and stock in the three floors of that wing.

Some West Point, Va., men, of whom E. Wilkinson is one of the leading spirits, are interested in the $1,000,000 manufacturing plant to be established there by Philadelphia capitalists on the site of the former Marsden cellulose factory.

The Signa Chemical Company, of which Dr. J. S. Dorian, of Niagara Falls, N. Y., is president, will build a factory in Wiscoy. Electrical energy will be developed from the falls

in the Wiscoy creek, where several hundred horse-power are available.

F. H. Clergue has announced his intention to build at Sault Ste. Marie, Mich., a mill to cost not less than $2,500,000 for the manufacture of news and wrapping paper. Pulp for the mill will be imported from the Clergue mills in the Canadian Soo.

At a meeting held in Philadelphia of stockholders of the Martin's Creek (Pa.) Portland Cement Company, it was decided to increase the bonded indebtedness of the company from $100,000 to $250,000. It is the intention to double the capacity of the plant.

A new company is to manufacture cotton thread in Springfield, Mass. E. L. Smith, of West Springfield, is the moving figure. The old Alden property is being enlarged and reconstructed to put it in condition for the new business, and much new machinery is being installed.

The Minneapolis (Minn.) Steel & Machinery Company has taken out building permits for a machinery plant to cost $94,000 and improvements at harvester works set down at $5,000. It is reported that some of the building which the company is doing is for foundry purposes.

The factory of the Railway Chronograph Company may be located in Beloit, Wis. A syndicate of capitalists from the East recently closed a contract with the company at Chicago, wherein they acquired the exclusive right to lease the chronograph on roads within a defined territory.

Plans are being prepared for a manufacturing plant for the Detroit (Mich.) Office & Bar Fixture Company, composed of Alphonse D. Posselius, Witzburger and Verbeiste. There will be a three-story brick factory, 60x160 feet; dry kilns and sheds, 70x80 feet, and a power-house, 40x50 feet.

The plant of the Londonderry Iron Works at Londonderry, N. S., has been destroyed by fire, throwing 125 men out of employment. The company had several large contracts on hand and the rolling mills were run day and night. The plant is owned by the Montreal Rolling Mills Company, of Montreal.

The property of the Troy Steel Company will be sold at auction at the City Hall, Albany, N. Y., August 7, to satisfy a judgment in favor of the Guaranty Trust Company, of New York, as trustee of the bondholders. The sale will be made by Frederick Townsend, referee. The plant has been idle for a long time.

The Delaware Marine Supply & Manufacturing Company, Wilmington, has let a contract to erect its buildings at Twenty-fifth and the Baltimore & Ohio Railroad. A machine shop, foundry and boiler-house will be built. The company will manufacture brass specialties. Mr. Peterson is president, and C. Leslie Bonham, secretary.

The Miskimen Furnace Company, of Logansport, Ind., has been organized with a capital of $50,000. The following officers were elected: President, George W. Miskimen; vice-president, Horace J. Crismond; treasurer, George W. Walters; secretary, Harry T. Tomlinson. The company is about in shape to begin the manufacture of furnaces.

The Wilkes Pattern & Woodworking Company, Toledo, O., has selected a site for its plant, adjoining the Wilkes Foundry Company. The company has been incorporated with a capital stock of $10,000, with the following named incorporators: Charles T. Wilkes, H. H. Tunks, Thomas Davies, E. E. Hulce, W. D. Freeman and Charles H. Cummings.

The latest concern to enter the ranks of the independent steel companies is the United Steel Company, which will have a capital stock of $500,000 and which proposes to build works at Canton, Ohio. The prime movers are J. E. Carnahan, Edward Langenbach, Joseph Biechel, W. N. Irwin and William Blecker, the last named an engineer of Pittsburgh.

Papers have been filed for record at Chattanooga, Tenn., by which the American Brakeshoe Foundry Company, a New Jersey corporation, capitalized at $4,500,000, purchases the annex of the Ross-Meehan Foundry and the brakeshoe department in Chattanooga. The plant is to be enlarged and the present force of operatives will be doubled.

The Continental Sugar Refining Company, recently organized by American capitalists, proposes to put up a 200-ton plant in the State of Oaxaca, Mexico. The equipment, which will cost $200,000, will be bought in the United States. Louis Essig, of the Louis Essig Lumber Company, St. Louis, Mo., is one of the directors, also W. E. Phillips, of Pittsburgh, Pa.

The Emmert Manufacturing Company, of Waynesboro, Pa., manufacturer of patent universal vises, suffered the almost complete destruction of its factory by a cyclone, July 9. We understand, however, that, pending a complete restoration of manufacturing facilities, the company will have arrangements for filling orders on hand and those that reach it through regular channels.

An English syndicate, which has incorporated under the name California Farm & Fruit Company, to develop the Santa Clara del Norte Rancho, will establish a packing house, fruit curing works, machine shop and box factory. This company is closely connected with the Claravale Improvement Company, which has an office at 210 California Bank Building, Los Angeles.

The old Superior street cable power-house, in Cleveland, O., will be converted by the Glauber Brass Manufacturing Company, maker of plumbers' and steam fitters' goods, into an up-to-date brass foundry and factory. It is possible that an engine-room will be constructed outside of the main building. Electric power and lighting will be used throughout, and a private generating plant will be installed.

Fire destroyed the foundries and pattern storage houses of the Union Steam Specialty Company, Scranton, Pa., July 2, causing a loss of about $50,000. The company secured quarters for its patternmakers with the Green Ridge Lumber Company the following day, and is duplicating its patterns, and has also erected a temporary foundry building, 75x125 feet, which will be replaced about August 15 with a brick structure nearly twice the size of the old building. The machine shops and offices of the company were not damaged, and all tracings and records were preserved. Owing to the fact that the company had over 150 duplex pumps and about 40 tons of separators in stock, it does not anticipate any delay in filling orders, as it hopes to replace all patterns before its stock is exhausted.

I. B. Williams & Sons (main office, Dover, N. H.) are fitting up and stocking a Philadelphia store for the sale of their belting and lace leather, and will handle in conjunction a full line of mill, mine, railroad and engineers' supplies and power-transmission machinery, for which they are now prepared to accept Philadelphia agencies. Their store is located at 722 Arch street, in the center of the supply district, and was occupied for a number of years previously as a supply house. They have entered into partnership with Harry S. Huhn, who was manager of James Smith & Co. for about nineteen years, and later with James H. Billington; also Wm. J. M. Weaver, who was manager for E. F. Houghton & Co. and later for James Smith & Co. The management of this business will be under the direct supervision of these gentlemen.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Machinists' Co-operative Association, cor. of Atlantic av. and Boerum pl., Brooklyn, N. Y.

Will sell patented machinists' instrument of unusual merit. Morris Chamberlain, Bartley, N. J.

Fine and special machinery and experimental work guaranteed. Wyland Mfg. Co., Williamsport, Pa.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Foreman patternmaker wishes to change; a wide experience. Box 676, AMER. MACH.

Mechanical draftsman with shop experience desires position. Box 667, AM. MACH.

Machine shop foreman at liberty; first-class references; good executive ability. Box 642, AMERICAN MACHINIST.

A widely experienced machine shop foreman is open for engagement; references. Box 668, AMERICAN MACHINIST.

Tool designer wants position; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

Position wanted as manager of machine shop and foundry, by thoroughly competent man, familiar with all up-to-date methods. Address Box 663, AMERICAN MACHINIST.

Machinist and toolroom foreman, with 26 years' experience on special machinery, jigs, tools, dies and screw machines, wants position. Box 661, AMERICAN MACHINIST.

Practical mechanic and factory superintendent would like to hear from parties wanting a man in that capacity; can give good references. Box 655, AMER. MACHINIST.

Wanted—Position as machine shop foreman or assistant superintendent; 20 years' experience (8 years foreman); engine work preferred; reference. Address Box 645, AM. M.

Draftsman and designer, expert at designing presses and shears to any capacity and special machinery, first-class references, age 25, desires change. Box 678, AMER. MACH.

First-class mechanical draftsman, 2 years' shop and 8 years' office experience in Sweden on steam engines, boilers and general machinery, wants position. Box 657, AM. M.

Mechanical engineer, experienced in designing compound engines, superintending works and general engineering, is open for engagement. Box 675, AMERICAN MACHINIST.

German electrical engineer; best technical education; very great experience in designing electrical machinery; best references; good knowledge of English. Box 658, A. M.

Situation as foreman patternmaker; 12 years' experience; molding machines, sweep work and machinery patterns; strictly first class and up to date. 8 Florence st., Dover, N. H.

Designer, 29, technical graduate, wants position; 9 years' experience, engines, pumps, printing machinery, automatic screw machines, steam and gasoline automobiles. Box 670, AMERICAN MACHINIST.

Mechanical draftsman, competent in the designing of steam engines and general machinery, wishes to make change September 1; successful machines on the market; practical mechanic. Box 662, AMERICAN MACHINIST.

A gentleman with years of experience as a works manager is desirous of securing a position with some pushing manufacturing company where ability and practicability are needed and will be appreciated. Address Box 633, AMERICAN MACHINIST.

A widely experienced superintendent and manager of machine works, expert in best shop practice and construction, of reliable executive ability and high-class references, seeks position with progressive concern. Address Y., 635 W. 61st st., Chicago.

Mechanical electrical engineer, technical, 12 years shop, field, office and drawing room, will be open shortly for engagement as chief engineer, calculator, salesman or charge of erection; heavy machinery and electric traveling cranes specialty; expert in all branches electric crane business. Box 671, AMERICAN MACHINIST.

As superintendent of manufacturing concern, an M. E. graduate with 10 years' varied practical experience as designer, chief draftsman, master mechanic, etc.; experienced in producing tools, jigs and special machinery for economical manufacturing; a systematizer and inventor; young and energetic; salary $2,000. Box 648, AMER. MACHINIST.

Help Wanted.

Wanted—First-class patternmaker, familiar with machine tool work. Box 674, A. M.

Wanted—Half-dozen good machinery molders. Southern Foundry & Macaine Co., Knoxville, Tenn.

Wanted—Men in large cities to take orders for machine tools. Cochrane-Bly Machine Works, Rochester, N. Y.

First-class machine tool designer; a position to take charge is open to the right man. Address Box 606, AMERICAN MACHINIST.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Draftsman.—Wanted—A first-class draftsman on engine work; state experience, references and salary expected. The Ball & Wood Co., Elizabeth, N. J.

Wanted—A good modern machine tool designer, accustomed to extra heavy work. Apply, stating where employed, to Box 607, AMERICAN MACHINIST.

Ha! Ha! Only 40c. (stamps taken) for that 65c. hardened 6-inch rule; have a few left; write quick. E. H. Randall, 235 Wood ave., Springfield, Ohio.

Competent draftsman for machine shop in New York; experience in cane sugar machinery required. Address, with full particulars, Box 673, AMERICAN MACHINIST.

Wanted—A number of first-class pattern-makers at once; best wages paid; new shop and machinery. The Balkwill Pattern Works, 970 Hamilton st., Cleveland, Ohio.

Wanted—First-class draftsman and designer familiar with steam engineering and hydraulic work; steady employment. Address "Blind," care AMERICAN MACHINIST.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—A number of first-class machine pattern makers; good wages paid first-class men; state wages expected in answering. Address Box 672, AMERICAN MACHINIST.

Wanted—First-class machinery draftsman, thoroughly competent to design new macaiaery from ideas furnished. Address The American Laundry Machinery Co., Cincinnati, Ohio.

Wanted—Draftsman, experienced in designing under instructions; one accustomed to printing machinery preferred; state experience, wages expected and references. K., care AMERICAN MACHINIST.

Wanted—Man in toolroom for first-class work on Landis grinder, also first-class shaper hand in first-class shop; up-to-date tools; also one good milling machine hand. Box 660, AMERICAN MACHINIST.

General foreman on high-speed engine building; must be systematic and thoroughly up on modern shop practice; new shop and tools; permanent position with advancement to right man. B. M., care AMERICAN MACHINIST.

Machinist to take charge as foreman; one having experience in making small interchangeable parts; thorough live man; permanent position. Address, stating age, wages wanted and give references to Box 666, A. M.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Swedish-American Foremen.—Wanted—Two first-class Swedish-speaking machine shop foremen, well up to date in modern shop practice. Apply in Swedish, stating age, experience and wages expected. Address Aktiebolaget Separator, Stockholm, Sweden.

Wanted—First-class detail draftsman, experienced on machine tool work; factory 100 miles from Chicago; a first-class man who can command good pay only wanted; married man looking for steady position preferred. Address Box 664, AMER. MACH.

Wanted—Assistant manager for plant manufacturing automatic engines and similar machines; limited number of men; must be a good manager of men and thoroughly up on handling work systematically and expeditiously. Address G. B., care AMER. MACHINIST.

Wanted—Thoroughly competent foreman on machine tool building, experienced in building pipe threading machinery, familiar with methods of producing duplicate parts on turret lathes; give age, experience, salary expected and references. Box 237, AMER. MACH.

Young man, about 25, with engineering and technical education and having some practical experience, wanted to go to Johannesburg to take position in engineering sales department of an established company there representing American manufacturers. Address "South Africa," care AMER. MACH.

Wanted—A first-class designing draftsman, $35 per week; previous experience in the work handled by the advertiser considered less important than good, general experience and thorough knowledge of shop methods; state age, education and previous experience. Address P. S., care AM. MACH.

A good designer is wanted by a firm building a line of grinding machinery; should have experience in this line and some experience in pattern making; a man with good ideas is wanted more than an expert draftsman; write fully as to age, experience and wages expected. "Massachusetts," care A. M.

Designing Draftsman; $30 Per Week.—Wanted—A first-class designing draftsman; previous experience in the work handled by the advertiser is considered less important than good general experience and thorough knowledge of shop methods; state age, education and previous experience. Box 659, AMERICAN MACHINIST.

Cost manager; a man conversant with and having had experience in making up factory costs, with a knowledge of factory accounting and of shop methods; competent to take charge of, modify or improve an existing system, etc.; man having had experience in valve works or similar work preferred. Address Box 665, AMERICAN MACHINIST.

Machinist Wanted.—To keep pace with our rapid growth we need an additional number of experienced machinists; we want steady men of good habits, looking for permanent positions; school, home and health advantages of Madison are unsurpassed; write immediately for particulars; state age, experience, etc. Northern Electrical Mfg. Co., Madison, Wis.

Wanted—An energetic young man with practical foundry experience and executive ability to take position as foundry order clerk in growing manufacturing concern, who are now buying castings from several jobbing foundries but who intend building foundry in near future and want a man in this position who can eventually take charge of the foundry. Box 669, AMERICAN MACHINIST.

Wanted—Two machine foremen, two bench and erecting foremen, one leading hand on tool and jig work; men wanted accustomed to modern shop methods; line of work, pumping machinery; permanent positions for competent men; state age, experience and wages expected; there are no labor troubles in San Francisco in our line of work. Geo. E. Dow Pumping Engine Co., San Francisco, Cal.

Superintendent-Manager.—Wanted—A thoroughly competent superintendent and manager in superior class manufacturing shop; preferably technically trained, with ample practical experience, accustomed to highly refined work, and having some experience in management as well as superintendence. Address, in confidence, stating qualifications, salary expected and other pertinent particulars. Box 656, AMERICAN MACHINIST.

Wanted.—Machinists, toolmakers, draftsmen, do you want to increase your salary? They all say that Saunders' enlarged edition "Hand Book Practical Mechanics" exactly fills the bill for valuable shop kinks, rules, etc., figured out by simple arithmetic and drawings; also most complete reference tables in existence, many taken from note books of best mechanics in the country. Pocket size. Price, post paid, only $1, cloth; $1.25 leather. Agents wanted. Book sells itself. Big money. C. H. Saunders, 216 Purchase st., Boston, Mass.

Wanted—Experienced foundryman; we are about to erect a thoroughly up-to-date foundry, suited for high grade machine tool and other work, and require the services of a man as superintendent or general foreman of same; applicants must thoroughly understand foundry practice and be competent to assist in planning same in all its branches; none need apply who are not now holding positions of responsibility in modern foundries; are willing to pay highest salary to right kind of man. Address, stating age, experience, names of past employers, etc., Box 677, AMERICAN MACHINIST.

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Abrasive Materials

Abrasive Material Co., Phila., Pa.
Carborundum Co., Niagara Falls, N. Y.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.

Accident Cabinet

Putnam & Co., New York.

Arbor Press

Barnes Co., W. F. & John., Rockford, Ill.
Bartlett, E. E., Boston, Mass.

Ball Bearings

See Roller Bearings.

Balls, Steel

Automobile & Cycle Parts Co., Cleveland, O.
Grant Tool Works, Franklin, Pa.

Bars, Boring

Cleveland Twist Drill Co., Cleveland, O.
Underwood & Co., H. B., Philadelphia, Pa.

Barrels, Steel

Cleveland Wire Spring Co., Cleveland, O.

Bearing Metal

Phosphor Bronze Smelting Co., Philadelphia, Pa.

Belt Dressing

Dixon Crucible Co., Jos., Jersey City, N. J.
Houghton & Co., E. F., Philadelphia, Pa.

Belt Lacing Machines

Diamond Drill & Mach. Co., Birdsboro, Pa.

Belting, Leather

Shultz Belting Co., St. Louis, Mo.

Bending Machines, Hydraulic

Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Bending Machines, Power

Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Reade Mchry Co., Cleveland, O.

Blocks and Tackles

See Hoists, Hand.

Blowers

Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.

Boilers

Struthers, Wells & Co., Warren, Pa.

Bolt and Nut Machinery

Acme Mchry. Co., Cleveland, O.
Detrick & Harvey Mach. Co., Baltimore, Md.
Pratt & Whitney Co., Hartford, Conn.
Wells Bros. Co., Greenfield, Mass.

Boring and Turning Mills

American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Books, Mechanical

Audel & Co., Theo., New York.
Baird & Co., Henry Carey, Philadelphia, Pa.
Henley & Co., N. W., New York.

Boring and Drilling Machines, Horizontal

Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., N. Y. City.
Betts Mach. Co., Wilmington, Del.
Binsse Mach. Co., Newark, N. J.
Dallett & Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fosdick Mach. Tool Co., Cincinnati, O.
Franklin Mach. Wks., Phila., Pa.
McCabe, J. J., New York.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Carborundum
See Grinding.

Castings, Aluminum and Bronze
Christensen Engineering Co., Milwaukee, Wis.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Castings, Brass
Christensen Engr. Co., Milwaukee, Wis.
Nolte Brass Co., Springfield, O.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Iron
Taunton Loco. Mfg. Co., Taunton, Mass.

Castings, Motor
Graves Motor & Mfg. Co., St. Paul, Minn.

Castings, Steel
Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Newark, N. J.
U. S. Steel Co., Everett, Mass.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Centering Machines
Bement, Miles & Co., New York.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Tool Works Co., New York.
Phoenix Mfg. Co., Hartford, Ct.
Pond Mach. Tool Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Chucking Machines
Cleveland Mach. Screw Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Chains, Driving
Automobile & Cycle Parts Co., Cleveland, O.
Boston Gear Works, Boston, Mass.
Bridgeport Chain Co., Bridgeport, Conn.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Whitney Mfg. Co., Hartford, Ct.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Gates Co., Fred P., New London, Conn.
Goodell-Pratt Co., Greenfield, Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankford, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
The E. Horton & Son Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.

Codes
Lieber Code Co., New York.

Collars, Split
Central Fdry. & Mach. Co., Reading, Pa.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Coil Clutch Mfg. Co., New York.
Eastern Mchry. Co., New Haven, Conn.
Faneuil Watch Tool Co., Boston, Mass.
Jacobson Mach. Mfg. Co., Warren, Pa.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

Compressors, Air
Blanchard Mach. Co., Boston, Mass.
Chicago Pneumatic Tool Co., Chicago, Ill.
Christensen Engineering Co., Milwaukee, Wis.
Clayton Air Compressor Wks., New York.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Gray-Blaisdell Co., Bradford, Pa.
Ingersoll-Sergeant Drill Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Rand Drill Co., New York.

Consulting Engineer
Thompson, Hugh L., Waterbury, Conn.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.

Correspondence Schools
See Schools, Correspondence.

Countershafts
Builders' Iron Fdry., Provi., R. I.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Reeves Pulley Co., Columbus, Ind.
Wheaton Mach. Co., Boston, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.

Couplings, Shaft
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.

Cranes
Brown Hoisting Mach. Co., N. Y. City.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutting off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Diamond Tools
Dickinson, Thos. L., New York.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Mdoern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Drafting Machine
Universal Drafting Mach. Co., Cleveland, O.

Drawing Boards
Rich, J. & G., Philadelphia, Pa.

Drawing Instruments
Alteneder & Son, Theo., Philadelphia, Pa.
Aurora Tool Wks., Aurora, Ind.
Keuffel & Esser Co., New York.

Drilling Machines, Boiler
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Gang Co., Wm. E., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., B., Worcester, Mass.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.
Snyder, J. E., Worcester, Mass.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrically-Driven Tools.
Clark, Jr., & Co., Jas., Louisville, Ky.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Electro-Plating
Miami Mfg. & Plating Co., Hamilton, O.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Backus Water Motor Co., Newark, N. J.
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Struthers, Wells & Co., Warren, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Eye Shield
McDougal, W. H., Charleston, W. Va.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.
Troy File Wks., Troy, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Westmoreland Steel Co., Pittsburgh, Pa.
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm. E., Chicago, Ill.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
N. Y. Gear Wks., Brooklyn, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Turley, H. G., St. Louis, Mo.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Browning Mfg. Co., Milwaukee, Wis.
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Modern Tool Co., Erie, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Safety Emery Wheel Co., Springfield, Mass.
Vitrified Wheel Co., Westfield, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.

Grindstones
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Eastern Mchry. Co., New Haven, Conn.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Enginering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Holder, Tool and File
Bowers, Geo. W., Waltham, Mass.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fairbanks Mach. Tool Co., Cincinnati, O.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.

Lathes—*Continued*
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply So., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rowbottom Mach. Co., Waterbury, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.
Murdock Parlor Grate Co., Boston, Mass.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Lathe
New Britain Mach. Co., New Britain, Conn.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Cullen, Orlan Clyde, Washington, D. C.
Frothingham, N. L., New York.
Straley, Hasbrouck & Schloeder, New York.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Machinery Exchange, Chicago, Ill.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Falkwill Pattern Works, Cleveland, O.
Gobeille Pattern Co., Cleveland, O.
Topping, Jas. R., Hartford, Conn.

Pipe and Fittings
Crane Co., Chicago, Ill.

Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers, Portable
Morton Mfg. Co., Muskegon Heights, Mich.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Planers
American Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Presses, Hand
Elmes Engr. Wks., Chas. F., Chicago, Ill.

Presses, Hydraulic
Bement, Miles & Co., New York.
Elmes Engr. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Elmes Engr. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Reamers
Chadwick & Co., G. B., Portsmouth, N. H.
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting.
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
American Ball Bearing Co., Boston, Mass.
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
Purdue University, Lafayette, Ind.
Worcester Poly. Institute, Worcester, Mass.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Chicago House Wrecking Co., Chicago, Ill.
Dawson, John H., Chicago, Ill.
Dustin Co., Chas. E., New York.
Fairbanks Co., New York.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.
York Mchry. Co., S. M., Cleveland, O.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Separators, Oil
Springfield Separator Co., Springfield, Vt.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New Haven.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Smith & Mills, Cincinnati, O.
Steptoe & Co., John, Cincinnati, O.

Shapers, Vertical Die
Rochester Die Shaper Co., Rochester, N. Y.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
Herman Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriache & Bell, New York.
Westmoreland Steel Co., Pittsburgh, Pa.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Straightener, Screw
Towsley Mfg. Co., John T., Cincinnati, O.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Trucks, Shop
Towsley Mfg. Co., John T., Cincinnati, O.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Foster, Walter H., New York.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Unions, Brass
Nolte Brass Co., Springfield, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Hollands Mfg. Co., Erie, Pa.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automobile Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Surface Grinding Attachment for a Universal Grinder.

Some time ago ye editor saw in the experimental and jobbing shop of Frederick Hart, at Poughkeepsie, an attachment to a B. & S. universal grinder that seemed capable of exerting a very useful influence upon the quality of work done and its cost. Mr. Hart was asked to co-operate with us in presenting it to our readers, and has recently sent us the photographs from which the accompanying engravings were made, and regarding them he writes as follows:

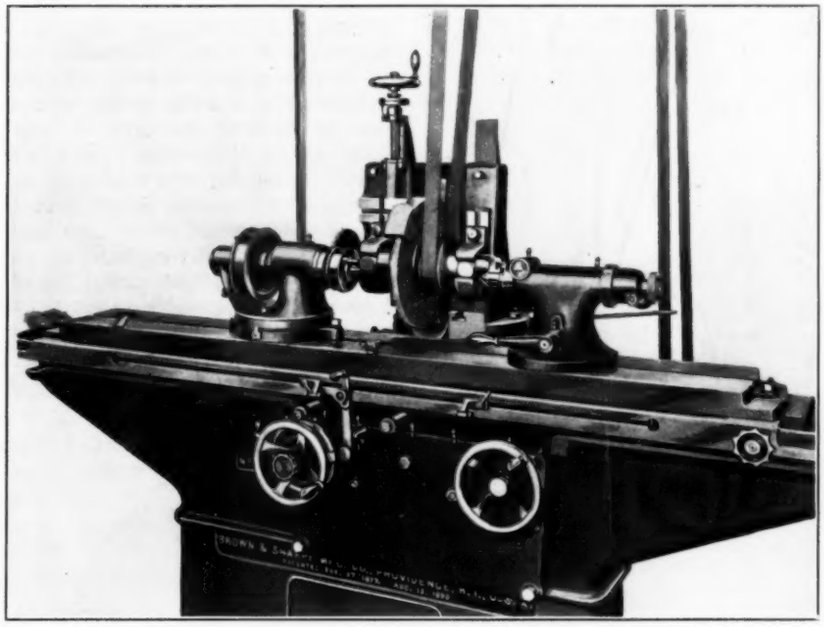


FIG. 1. UNIVERSAL GRINDER WITH SURFACE GRINDING ATTACHMENT.

"Enclosed please find photographs showing the alteration to the universal grinder which you saw when you were here some time since, and of which you said you would like to have photographs for publication in the AMERICAN MACHINIST. As I told you, we put this attachment on the grinder just after we bought it, now some six years ago, so as to enable us to do surface grinding with it as well as cylindrical. Quite often we had surface grinding to do, but not enough to make it pay to put in a surface grinder of sufficient size to take the work, so after some consideration we made this vertical slide and attached it to the machine.

"Fig. 1 shows the machine as used for cylindrical grinding with the vertical slide in place.

"Fig. 2 shows how it is located for internal grinding.

"Fig. 3 shows it for surface grinding.

"Fig. 4 shows the alteration that was made to the overhead gear to take up the slack of the belt.

"It will be noticed that the vertical slide remains almost in the same position for either cylindrical, internal or surface grinding. It is sometimes necessary on some work to take out the large wheel and move the vertical slide further back on the table, but the majority of the work can be done by simply attaching the wheel to the end of the spindle. The T-slot at the left of the wheel is for attaching a guard for the overhanging wheel, but this was omitted in the photograph, as it somewhat obscured the mechanism.

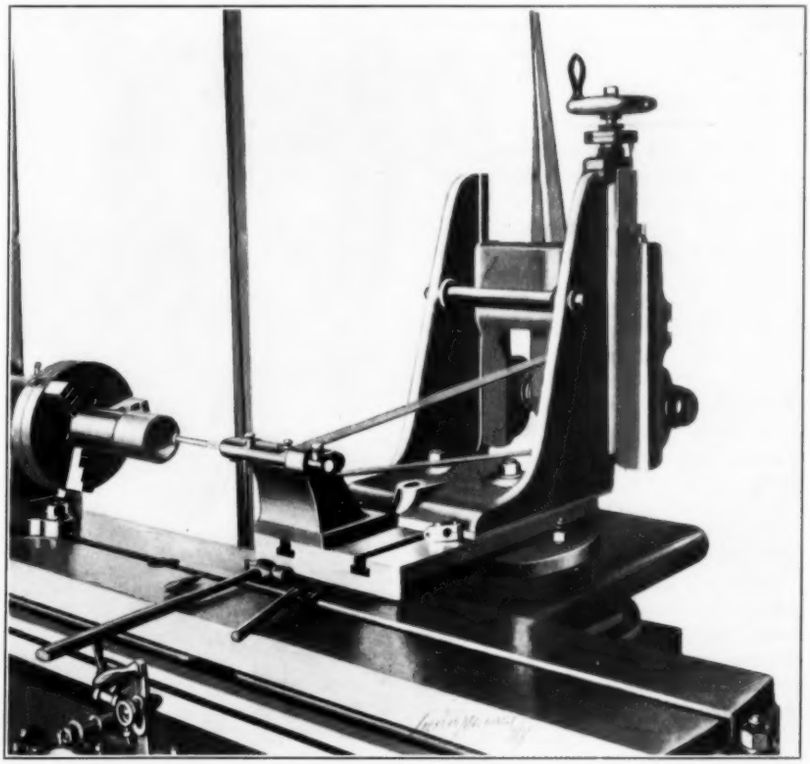


FIG. 2. UNIVERSAL GRINDER WITH SURFACE GRINDING ATTACHMENT IN USE FOR INTERNAL GRINDING.

"The alteration made to the overhead gear was the taking off of two of the bearing boxes and replacing them with the circular track shown. The center of this track was, of course, the center of the first-motion shaft of the overhead gear. Then the bearing boxes were attached to this slide, and balanced with a weight which was connected to both boxes by a wire rope. The pump pulley was taken off of this shaft, and placed on the first-motion shaft, and two guide wheels attached to the side of one of the circular tracks. The balance-weight was, of course, of sufficient weight not only to balance the shaft and pulleys, but also to give sufficient tension on the wheel belt.

"This whole apparatus has been at work now for some six years, and we have found it of very great service, as the alteration in no way impedes or interferes with either cylindrical or internal grinding, and the change is as easily made with this standard for the emery wheel as it was when the original standard was on the machine."

Not all shops have much use for a surface grinder, but in very many of them the ability to do such a job of work as can be done by this attachment would be a very great advantage, and its use would be apt in many cases to show a previously unexpected necessity for a regular surface grinder.

It will be understood of course that all the usual motions of the machine are available for use in surface grinding, *i. e.*, the work is clamped to the platen or held in a vise attached to it and, the machine being started up, the work will be passed under the wheel back and forth, while at each

pass the automatic cross-feed will advance the wheel toward the front until the whole surface has been ground. A feature which especially commends the device is that it need not be removed when work other than that for which it is made is to be done, but, as shown by the photographs, it is kept in place no matter whether surface; cylindrical or internal work is to be ground.

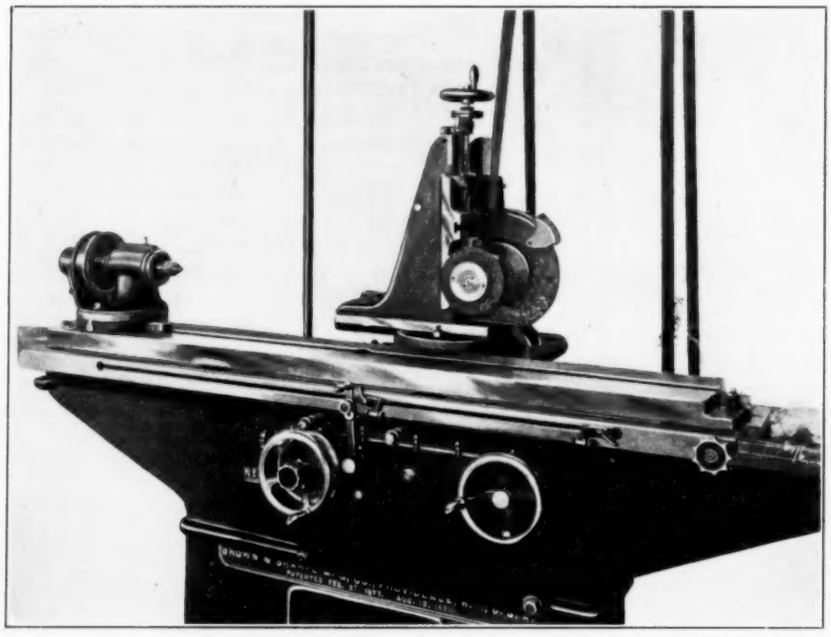


FIG. 3. SURFACE GRINDING ATTACHMENT IN POSITION FOR WORK.

The Distribution of Trade Catalogs.

We reprint a letter which tells its own story completely, and it is not really necessary for us to say a word in connection with it. The letter, however, touches upon and illuminates a topic which has frequently been treated in our columns and one which is always interesting and always open for additional enlightenment. We cannot wonder that manufacturers who spend large amounts of money in getting out attractive and really valuable enumerations and illustrations and descriptions of their products do not want to throw them away. They are of course urgently desirous that they shall accomplish abundantly their pre-appointed mission. And here arises the question as to their distribution. Shall they be given exclusively to those who are in positions to be actual purchasers? Shall they not also, or, we might almost say, shall they not by preference be given to those who are presumably the advisers of and who are able to favorably influence the possible purchasers? The foremen of shops and the leading workmen have definite and valuable opinions as to the applicability, reliability, accuracy and other qualities of the tools that they know, and they, in this country at least, are free to express their opinions to the boss and he is largely influenced by them in his purchases. If men of this class have enterprise enough to write and ask for catalogs and other trade publications that are gratuitously distributed we think that as a general rule the distributor should welcome such opportunities. The letters may be written on cheap stationery and have every evidence about them that they do not come from the office of any large establishment, but they still come usually from thinking and interested and influential men of the shop, and we certainly favor a liberal acceding to their requests. The letter referred to was sent to us by the company to whom it is addressed and incidentally it shows what their policy is about sending catalogs. The letter is as follows:

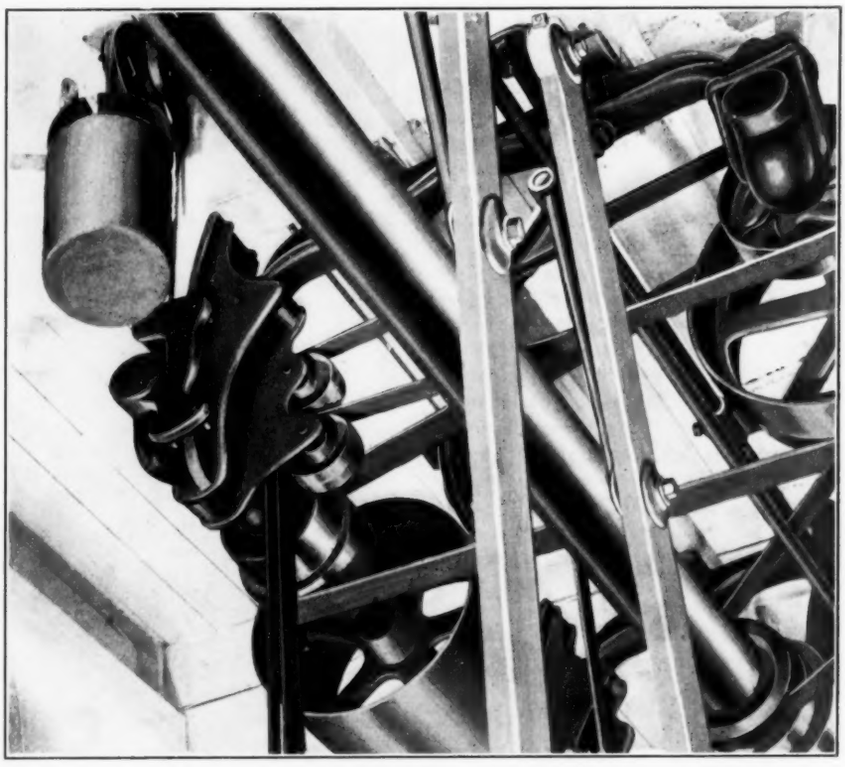


FIG. 4. SHOWING CHANGES MADE IN OVERHEAD WORKS FOR SURFACE GRINDING ATTACHMENT.

Cincinnati Milling Machine Company:

Gentlemen: About two years ago I wrote you from —— ——, requesting catalogs on your milling machines, also your universal cutter and tool grinder, and received the same in due time, but failed to acknowledge their receipt. I wish to do so now, and am pleased to inform you that the valuable information gained from the study of them was the *direct* cause of the installation of one of your latest all gear feed No. 2 universal millers and also one of your cutter and tool grinders in one of the departments in which I am now foreman.

I am moved to write this from reading the discussions that have been going on in the AMERICAN MACHINIST whether or not it pays the tool builders to send their catalogs to applicants when all the indications point to the fact that the applicant is not in the position of a buyer. Now, while I have not taken part in the discussion mentioned, I have always claimed that if a workman or foreman took enough interest in machines to send for a catalog of them, he surely took enough interest to study them.

While I am well enough acquainted with some other makes of universal millers and grinders, I was not in position to speak

with any degree of assurance regarding the "Cincinnati" until I obtained your catalog, and then, when the opportunity came, I knew what I was talking about. When the machine came it proved all I said. Everybody who examines it takes his hat off to it. It is all O. K.

I thought I would like to have you know that your kindness in sending the catalog promptly at that time was not wasted, and I hope that every catalog so sent may be equally productive of sales, only in a little better time perhaps. Wishing you continued success, I am,

Yours very truly,

—— ——.

The 16-Inch Rifle.

We have given our readers full information regarding the 16-inch breech-loading rifle recently completed at Watervliet and

the methods employed in constructing it. Numerous illustrations have been given of the shop in which it was built, of the lathe constructed at the Pond works for boring and turning it, and finally of the gun itself. An Albany photographer sends us the picture of the man herewith presented as he reposes within the muzzle of the gun, thus giving, we think, a very vivid idea of the magnitude of this, the most powerful gun ever constructed.

In the production of "antique" furniture in Italy, the worm-hole maker is said to be one of the most important workmen. The tool that he principally uses is a shot-gun.

Echoes from the Oil Country.

THE INEQUITABLE APPRECIATION OF HAND WORK.

I wish to enter a protest—"a kick," as we say in the shop.

I bought a magazine the other day, one of the dignified kind supposed to give a busy man a glimpse of some of the important things happening in the world, and to give it in a fair, open, unbiased way. In it I found an article at which I here kick. It was one calling attention to a revival of certain kinds of skilled hand work whereby some people, with a good degree of skill and originality, are able to make wares that command a relatively large price because of the fact that they are made in small quantities and cannot be duplicated at the nearest store, the trade mark of the maker being the chief item of value as showing that the article is unique.

So far I have no reason to object, believing as I do that it is good business to work at that which brings in the best returns for the effort expended. What I do object to—and that most vigorously—is the insinuation that the every-day worker is below these in honesty and usefulness.

Allow me to quote from the article: "Machine-made things we must have and always will have, and it is fortunate indeed that machinery can and does supply many human wants at such low cost. With it all there remains a survival of the old mediæval love of the honest, hand-made thing."

The insinuation in this quotation that the ordinary product of the shops and factories is not honest; that those working in such places are on a lower plane, personally and as to usefulness, than the world at large, is what I object to. Such writings, while seemingly insignificant in themselves, assist in creating a lasting impression. To just such things do we owe some of the feeling that is all too common, even in this country, that to be a doctor or a lawyer, a preacher or a banker is more *honorable* than to be a mechanic.

Take away the mechanics, and the advancement caused by the low costs made possible by the very machinery here so slightingly spoken of, and the world's progress is stopped and we are at best in a state of semi-civilization.

As a machinist I want to take my stand as belonging to a class second to none in importance to the world. There are other callings in the same rank with us, and they are the other trades: the molders, blacksmiths, steel makers, iron workers and others intimately allied.

To insinuate that a few workers, however excellent their product, whose chief aim is to get large prices for things the greatest values of which lie in the fact that they are possessed by but few, and who have it not in their power to make life easier or more pleasant are in a class by themselves, is an unjustice to every honest toiler in the land. We as individuals should promptly resent these things that tend to create a false impression as to our importance to the world.

This may seem like a small matter to many, but, friends, look around you and see how many young people prefer to follow vocations where they can be pseudo-genteel at starvation wages rather than throw their energy into shop work.

Just as a few drunken mechanics can create an impression in a community that they are fair samples of all good mechanics, so such ill-considered writings can create an undercurrent of feeling that shop work is lowering, and that to engage in making anything made in large quantity by the aid of machinery one must give up a certain measure of manhood or womanhood. Whatever other differences we may have we should be as a unit in upholding the honesty and dignity of labor in general and of our own calling in particular.

"He came from poor but honest parents." Who has never noticed such a sentence in describing someone who has acquired wealth or distinction? How would this look: "He came from rich but honest parents"? It would be resented by every rich man that read it, but isn't it just as false when said of the poor?

More than once have I been asked by parties in the trade as well as by parties not in it, "Why is it that most of the best machinists are intemperate men?"

To this I can reply that in my own experience they are not. The man who gets drunk is usually far from modest in telling of his ability, especially when

drinking, and a great many people seem to take him at his own valuation. The really valuable mechanic has very little time to "blow his own horn," and so his work is often not appreciated, except by those who come in closest contact with him. A good man may become addicted to the use of intoxicants, but his value is never increased thereby, neither is it safe to reason: "Good mechanics get drunk, *therefore* if I get drunk I will be a good mechanic," although I regret to say that I have known a number of young men who seemed to follow such a line of reasoning.

I do not wish to trespass on the patience of my fellow-craftsmen, but it does seem to me that a little effort spent in producing a proper understanding of ourselves by the community at large will bring just as good returns as getting out a formula for the flow of water. We should all labor to produce an "atmosphere" (as the artist would call it) of respect and admiration for our calling.

In some callings a man is looked on as a gentleman because of his calling, while in others it is considered that if he is one it is in spite of his calling, and we should see to it that our calling is not looked on in the latter way for the lack of information.

W. OSBORNE.

FIG. 1. ACTION OF A SPLIT PASTEBOARD TUBE UNDER A TWISTING STRAIN.

FIG. 2. A TWIST DRILL CHIP.

Drilling Extraordinary.

Reports have been circulating about for some time regarding unprecedented rates of feed which the Bickford Drill & Tool Company have found to be feasible with ordinary commercial twist drills. These reports have been received in many quarters with a good deal of incredulity, and at a recent visit to the Bickford works we took some pains to look into the matter. While we cannot say that all of the work described below came under our own eyes, we saw enough to convince us that the statements are made in entire good faith and that they are facts.

It is certainly somewhat startling to be told that drills of ⅜ inch diameter and larger cannot be broken in a well-designed drill press when drilling cast iron from the solid at suitable speeds, under a feed of 1-16 inch per revolution, and the average man may feel disposed to dismiss the statement by saying that he knows better, because he has broken, and seen broken, many such drills under lower rates of feed. It is proper, therefore, to begin this article by giving Mr. Norris's explanation of the results which are obtained on the "New Radial" drilling machine of the Bickford Company. This machine was described at length at page 1177, Vol. 24, reference to which article will show that the two leading features of the machine are a much larger number of speeds and feeds with much faster feeds than are customary. It is, of course, one thing to make a drilling machine with such feeds and another to make the drills stand up under them, and according to Mr. Norris the explanation of the fact that the drills do stand these feeds in his machine is to be found in the form of the arm. In his view, designers of radial drills have aimed at stiffness in the arm when considered as a beam in flexure, but have overlooked the question of stiffness against torsion due to the offset of the center of the drill spindle from the center of the arm. To resist torsional strains a complete tube is, of course, well known to be the best form, though Mr. Norris claims to be the first to apply this section to a radial drill arm. To illustrate the importance of a *complete* tube he has devised an illustration which, in simplicity and effectiveness, is worthy of Professor Sweet. To appreciate its force the reader will have to make a little experiment which we can illustrate, but the full force of which can only be gathered from actual trial. Let the reader take a piece of common pasteboard mailing tube, 8 or 10 inches long, in the two hands and twist it. It will, of course, be found to be quite stiff and unyielding. Next slit the tube its entire length with a penknife, as shown in Fig. 1, and twist it again. Its stiffness against torsion will be found to be gone. There is simply no comparison in the strength of the tube before and after slitting. In the former condition it has a good deal of strength, while in the latter it has none. When the tube is slit and then twisted the two edges of the cut slide on one another in the manner which we have tried to show in the illustration, and this sliding takes place with the most trifling effort.

Mr. Norris's contention is that the usual gap in the front side of the arms of radial drilling machines is equivalent to the slit in the pasteboard tube, and that the spring and chatter due to it break the drills un-

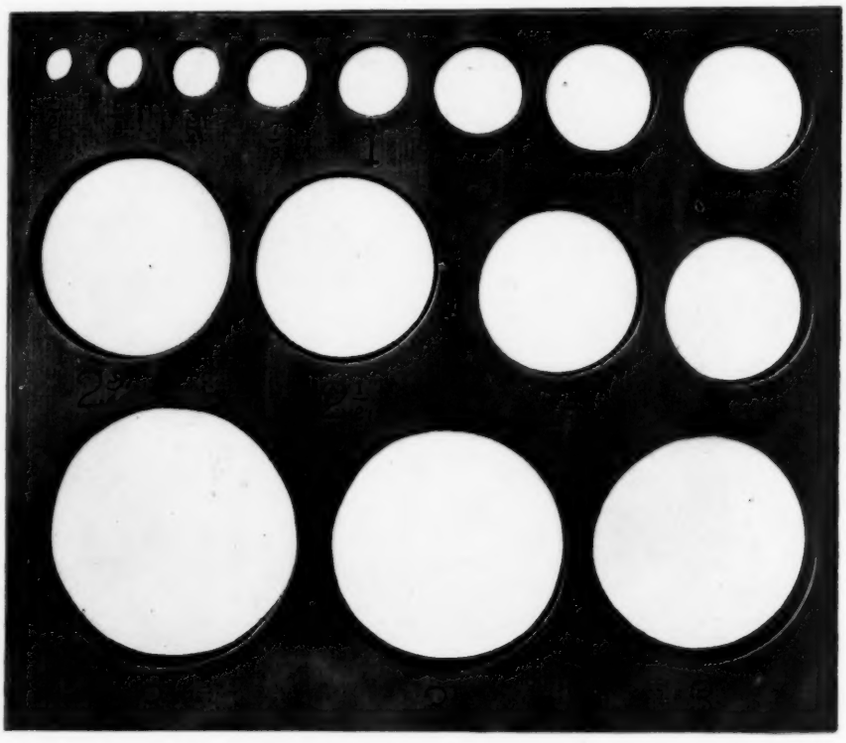


FIG. 3. EXHIBITION SAMPLE OF FAST DRILLING.

der feeds at which they would work successfully were the spring absent. There are certain things which appear to weaken the argument, especially the heads at the ends of the arms, which, in a measure, resist the sliding tendency of the edges of the gap. It is quite possible also that, as regards their capacity to endure punishment, twist drills have improved in recent years more rapidly than either their makers or users have realized, and this may be a large factor in these results.

Whatever the explanation may be, it does not affect the interest which attaches to these results. The rates of feed for twist drills which were established long ago by the Morse Twist Drill & Machine Company, and which have almost the force of tradition, are given in Table 1.

Size of Drill.	Feed per Revolution.
¼ inch	.005 inch
½ "	.007 "
¾ "	.010 "

TABLE 1. MORSE FEEDS FOR TWIST DRILLS.

The feeds provided in the latest pattern of the Bickford radial and the drills with which they are used in the Bickford shops, so far as usage is established, are given in Table 2, the material being an ordinary grade of cast iron.

Size of Drill.	Feed per Revolution.
....	.007 inch
....	.010 "
....	.013 "
....	.018 "
¼ to ½ inch	.025 "
½ to 1 "	.035 "
1 to 1½ "	.047 "
....	.064 "

TABLE 2. BICKFORD FEEDS FOR TWIST DRILLS.

It will be seen that the highest feed of the Morse list is next to the lowest of the Bickford list, while, for ¾-inch drills, the Bickford feed is three and a half times the Morse feed. It will be seen also that the finer feeds are not apportioned at all, as in regular work in cast iron they are not used. The coarsest feed is used mainly for such operations as reaming, finish boring with a double end cutter and for opening up cored holes with a three-lip drill.

In order to learn what twist drills will stand many have been tested to destruction, with the results noted in Table 3. The first four of these tests were made before the present scale of feeds was adopted, which accounts for the feeds given in this table not agreeing with those given in the last one. It is to be understood, of course, that in all cases the drills stood up under all feeds below those given as the breaking feeds. That is, the 3-32 inch drill stood up under the .007 inch feed, the ⅛ inch under .01 inch, and so on. The tests were made in cast iron.

Size of Drill.	Feed per Revolution at which Drill Broke.
1-16 inch	.007 inch
3-32 "	.010 "
⅛ "	.014 "
5-32 "	.020 "
3-16 "	.035 "
¼ "	.047 "
5-16 "	.064 "

TABLE 3. BREAKING TESTS OF TWIST DRILLS IN CAST IRON.

Larger drills than 5-16 inch refused to break with any rate of feed fitted to the machine, the coarsest feed of .064 inch per revolution being insufficient to break a ⅜-inch drill. The speed at which this test was made was 267 revolutions per minute. Drilling at this speed under the above rate of feed gives 17 inches of drilled hole per minute, *which we saw done*, the drill going to its entire depth of 3 inches.

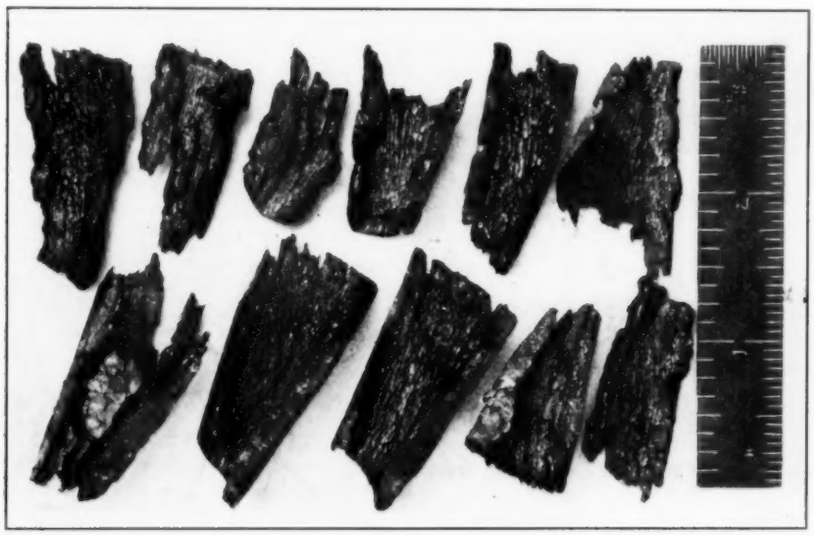


FIG. 4. CHIPS MADE WITH A 4-INCH FLAT DRILL OPERATING IN SOLID METAL AT THE RATE OF 1¼ INCHES PER MINUTE. MATERIAL, .45 CARBON STEEL; DEPTH, 4½ INCHES; SPEED, 17.68 REVOLUTIONS PER MINUTE; FEED, .012 INCH PER REVOLUTION; LUBRICANT, WATER; TOTAL TIME, 3.65 MINUTES.

Some experiments were made with larger drills in machinery steel, though without much success in breaking them. The machine used for this test had the tubular arm, but a belt feed, which feed was not, however, taken from the main spindle, but from another shaft running at more than twice the speed. The experiments were stopped in each case by the slipping of the belt at the rates of feed shown in Table 4.

Size of Drill.	Feed per Revolution at which Feed Belt Slipped.
1⅛ inches	.021 inch
2 "	.014 "
2¼ "	.011 "
3 "	.07 "

TABLE 4. TESTS OF TWIST DRILLS IN MACHINERY STEEL.

In another test a 1¼-inch drill stood up under a feed of .072 inch in steel, but broke when the feed was increased to .1 inch.

Perhaps the most remarkable of all the results obtained is that shown in Fig. 2, which is a half-tone made natural size from a chip taken from machinery steel by a 1 9-16 drill. No such feed as this is fitted to the machine, and this chip was taken with a hand feed which was progressively and rapidly increased until something happened. That something was not the breaking of the drill but the stopping of the machine. Being made by hand, the exact feed is not known, but it can be judged from the thickness of the chip, the chip being so located before the camera as to show its thickness, which measures 9-32 inch. There was no special preparation of the drills for these tests, the aim being to find the capacity of drills as ordinarily ground and used. The grinding was unchanged, except that the drills above 1½ inches had the centers point d up by hand on a thin emery wheel.

Another example of rapid drilling is shown in Fig. 4, which is a half-tone of some chips made with a 4-inch drill operating in solid metal at the rate of 1¼ inches per minute, or the equivalent of 6 feet 4 inches per hour.

Size of Drill.	Revolutions per minute.	Cutting Speed, Feet per Minute.
½	267	35
⅝	222	36
¾	184	36
⅞	153	35
1	128	33
1⅛	106	31
1¼	88	29
1½	73	28
1¾	61	28
2	51	26
2¼	42	25
2½	35	23
2¾	29	21
3	24	19
3¼	20	17
3½	17	15

TABLE 5. BICKFORD SPEEDS FOR TWIST DRILLS.

Our readers will recall the means pro-

vided for changing speeds and feeds quickly, which were fully described in the article already referred to. These quick changes along with the fast feeds are factors in the exhibition sample of drilling shown in Fig. 3, which shows fifteen holes in a plate of cast iron 1 inch thick, which were drilled in 26 minutes 53 seconds, this time including all changes of drills, speeds, etc., from the start to the finish. Each hole has its size stamped alongside.

Table 5 gives the turns per minute at which the Bickford Company regularly drives drills in cast iron, as well as the cutting speeds in feet per minute due to these revolutions. The table is the outgrowth of considerable experimenting. The speeds for ¼- and 2-inch drills agree with those established long ago by the Morse Twist Drill & Machine Company, but intermediate speeds are somewhat and in some cases materially faster. It is an undoubted fact that large drills cannot be operated at as high cutting speeds as small ones. The only explanation that has been offered for this fact, as far as we are aware, is the quicker absorption of heat due to the larger surface in contact between drill and work as compared with the work done in removing chips with small sizes of drills. The uniformity in the series of cutting speeds is remarkable and shows unusually careful work in laying out the train of gearing.

A Large Home-Made Horizontal Spindle Boring Machine.

A large horizontal boring machine was wanted, and after inquiry among makers it was decided not to buy, but to build. The general dimensions of the machine as we made it are:

Length over all, not including projection of boring bar—19 feet 6 inches.

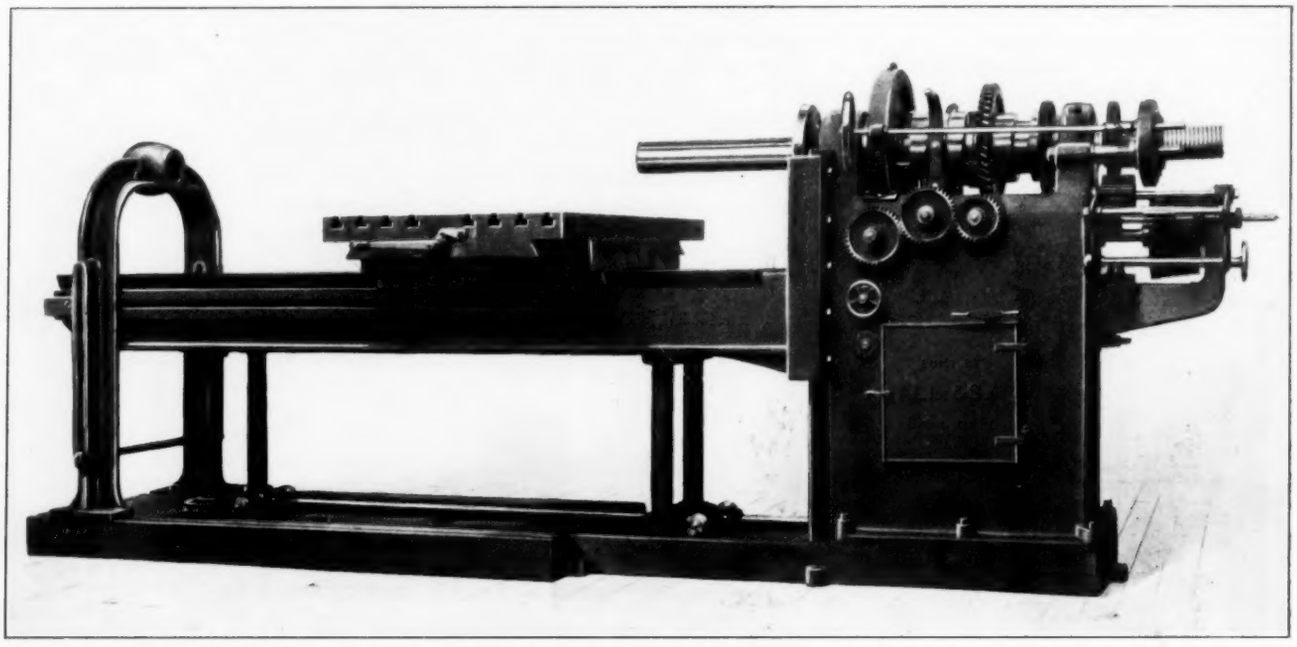


FIG. 1. FRONT SIDE OF LARGE BORING MACHINE.

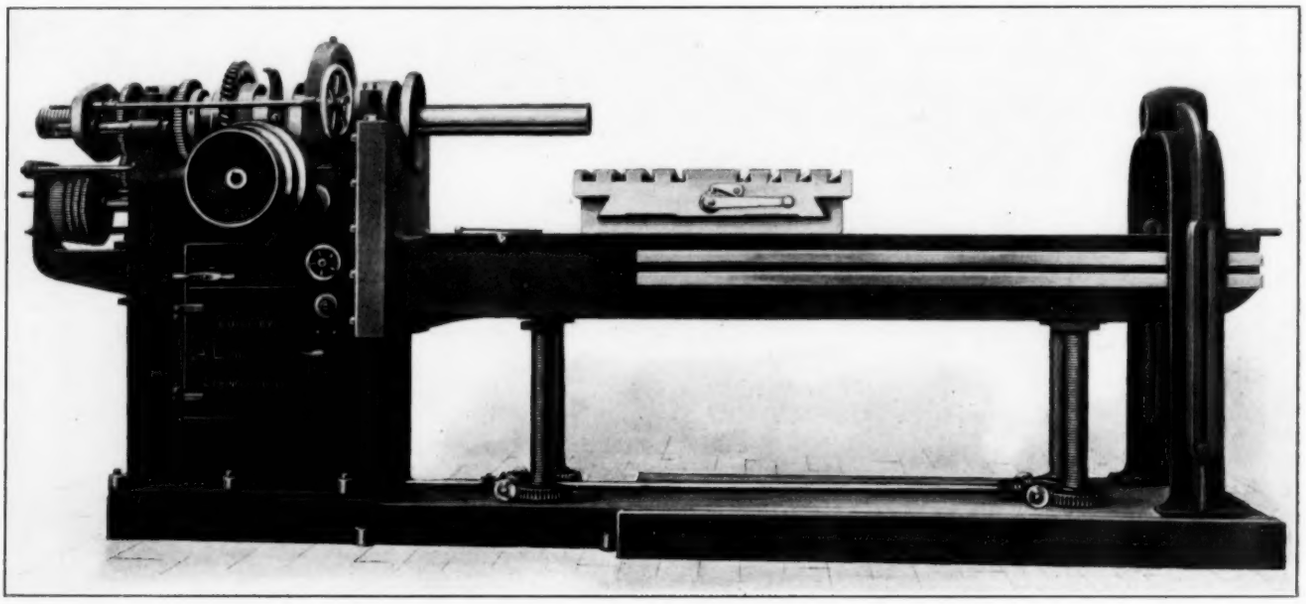


FIG. 2. REAR SIDE OF LARGE BORING MACHINE.

From center of spindle to bottom of bed plate—77 inches.

Diameter front bearing—10x8 ins. long.

Diameter back bearing—9½x6 inches long.

Length of spindle—53⅛ inches.

Diameter of face-plate on spindle—18 inches.

Diameter boring bar—6 inches.

Length of work table—96 inches.

Feed of table crosswise of machine—74 inches.

The machine has power feed in all necessary directions, including raising and lowering of table. The spindle is worm driven, the cover being shown removed from one of the worm wheels. The worm wheels run loose on the spindle and drive through a splined sliding clutch that can engage with either wheel. The relation in speed is 1 to 50 between the large wheel and driving pulley, and 1 to 13 between the small wheel and driving pulley. This relation can be further changed for special work by the change gears shown just above the door in Fig. 1. The cone pulley was never used, but a Reeves speed variator instead.

The machine was intended for long work, and the space available for it being rather limited, the total length required some attention. As these machines are generally made, the bars are driven by a rack and pinion at the back of the head, and with this method the bracket supporting the feeds has to be extended somewhat more than twice the length of feed. The bar can of course be shifted to a new position, but in long work this is not desirable, and to make this back extension as short as possible the feed shown in Fig. 3 was devised.

A is the spindle, *B* the boring bar on which is cut an Acme shape thread, ¼ inch wide, ¾ inch pitch. In this case the thread extends over a little more than half of the length of the bar, leaving the smooth portion at the front end. The wide flat top of thread affords sufficient bearing for the back end. *F* is a nut and

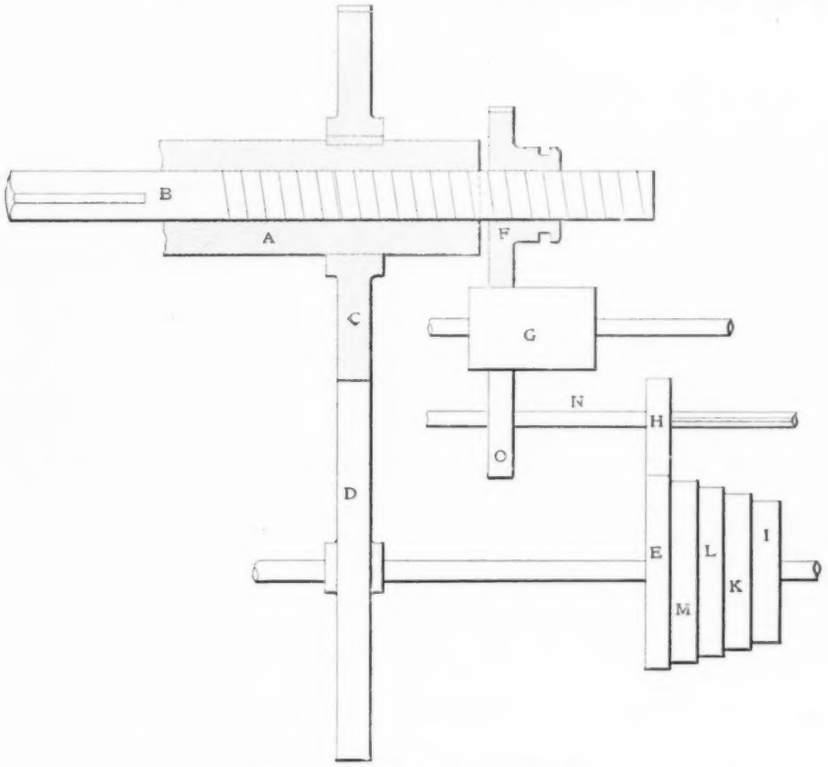


FIG. 3. FEED GEAR OF BORING BAR.

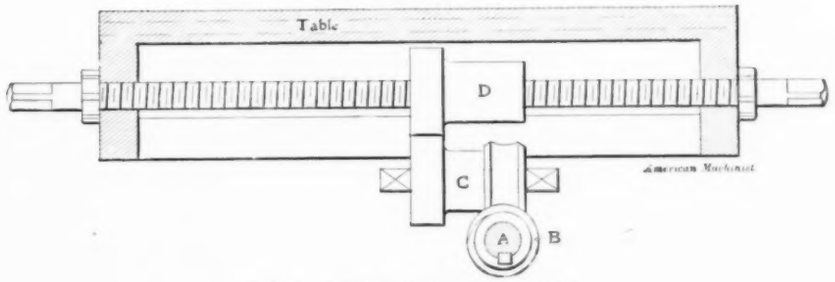


FIG. 4. FEED GEAR OF WORK TABLE.

gear combined with babbitted thread to fit the bar *B*. The nest of gears *E*, *M*, *L*, *K*, *I* is fastened to same shaft as gear *D*, and they revolve together.

If the gears *C* and *D* are the same size, also *E* and *F* and *H* and *O*, the nut and bar will revolve together and there will be no feed, but if gear *H* be shifted to engage with gear *M* the nut will run slower than the bar and it will feed according to the direction of the thread. To reverse the feed, a gear smaller than *H* is used, and it will be seen that for every gear here used five changes of feed can be obtained. The arrangement is especially useful in thread cutting, as any combination of gears can be had. No nuts or bolts are used for holding the gear *H*, the shaft on which it is supported being simply pulled out a short distance and held in place by a spring latch. This same shaft swings partly around gear *G*, permitting *H* to be put in mesh with any of the five feed gears.

The nut *F* is held in a yoke, as will be noticed in Figs. 1 and 2, and through the rods and hand-wheels shown in front of the head is movable for about 5 inches, endwise of the bar and independent of the power feed. This makes a very useful adjunct to the power feed, because with it the cutting tools can be advanced or drawn back with the feed on and without disturbing it. This feature is not found on any other of this class of machines and is appreciated after using it. The feed drive for the table consists of friction wheel and disk, arranged to give from 0 to ⅜ inch feed per revolution of boring bar.

The table carriage may appear to be not sufficiently deep, but it is made of three I-sections strongly braced, and is very rigid.

The table feed is very simple, and is shown in Fig. 4. *A* is a splined rod running lengthwise with the carriage and worm *B* slides on and revolves with it. *C* is a worm-wheel and gear combined, and *D* is a nut and gear combined. This gearing, including the screw, revolves one way or the other as desired, and when the table is wanted to move, the screw is held from turning by throwing in a pawl at one of the notched collars at each end of table. The whole feed gearing can be started or stopped by the small horizontal lever showing just above the door or headstock, and is adjusted or reversed by the small hand-wheel near it.

The table is very massive to resist springing and to take up vibration when milling. The whole design is such that the machine can be operated from either side, all levers and handles going through.

It was again verified that a quick pitch in a worm combination is more satisfactory than a slow one, as the small worm, which is triple, ran under the heaviest work it could do, perfectly cool, while the larger one, which is single, had a slight tendency to heat under a heavy cut, but not enough to give any trouble.

H. F.

Tests of Abrasives on the Gardner Disk Grinder.

Mr. F. N. Gardner, superintendent of the factory of C. H. Besly & Co., Beloit, Wis., has recently made some highly interesting tests of different kinds of abrasives when used on the Gardner grinder, and we are permitted to publish such of these tests as, by reason of the material operated upon and other conditions, are comparable with one another.

It is well known that the abrasive circles supplied for use on the Gardner grinder

have the abrasive material in the form of spirals, and the heading of the second column in the accompanying table indicates that the circle used in that test was of this kind. The abrasive material used in this test was a new one known as alphite, and the test is thus a comparison not only of the spiral paper as compared with the usual form, but of the alphite paper as compared with emery paper and emery cloth.

The tests were made by applying the end of one-inch square bars of soft steel to the revolving abrasive circle, the application being continued until the circle was worn out and the circle being dressed from time to time by the application of an emery-wheel dresser. The length of the bar was measured after each fifteen minute interval of grinding, and the total amount ground away in sixty-fourths of an inch is set down in he table opposite each numbered interval. The table therefore shows the life of the different kinds of circles, the total amount of steel ground away and the average amount ground away per minute during the life of the circles. The figures following the word "dresser" in the table indicate the number of times the dresser was applied during the various fifteen minute intervals. The machine used for the test was a No. 4 Gardner grinder having an 18-inch disk wheel and a swinging table.

No. of Interval (15 minutes each).	No. 36 Spiral Alphite Paper.	No. 36 Best obtainable Commercial Emery Cloth	No. 36 Best obtainable Commercial Emery Paper
1	108	67	65
2	190	105	79
3	246	148	120 Dresser 1
4 1st hour	286	199 Dresser 1	156 Dresser 3
5	342 Dresser 1	235 Dresser 1	169 Dresser 3
6	404 Dresser 1	256 Dresser 3	.....
7	448	284 Dresser 3	.....
8 2d hour	502 Dresser 1	307 Dresser 3	.....
9	546 Dresser 1	328 Dresser 3	.....
10	598 Dresser 1	352 Dresser 3	.....
11	627 Dresser 1	372 Dresser 3	.....
12 3d hour	653 Dresser 1	385 Dresser 3	.....
13 [illegible]	700 Dresser 1	.....	.....
14 (9 min.)	722 Dresser 1	.....	.....

Tests in Detail.

Kind of Circle.	Life of Circle.	Cubic Inches of Steel Removed. Per Min	Cubic Inches of Steel Removed. Total.	Number of Dressings.
Alphite Spiral	3 hrs. 24 min.	.0553	11 9-32	9
Emery Cloth	3 hrs.	.0334	6 1-64	23
Emery Paper	1 hr. 15 min.	.0352	2 41-64	7

Summary.

TEST OF ABRASIVES ON GARDNER GRINDER.

A New Factory Cost Accounting System.

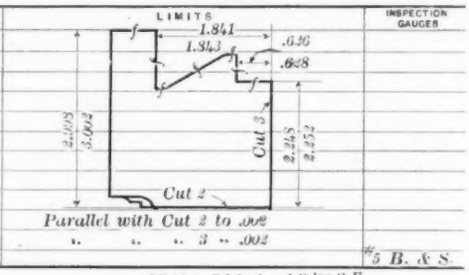
BY WILFRED BANCROFT.

Probably most cost systems grew out of the desire to know how cheaply a product might safely be sold, and although this information is quite as important as ever, the burning question, in these days of close competition, is not "How much did this piece cost?" but "Why did it cost so much?" The ideal cost system must not only answer the first question promptly and accurately, but must also display, when required, all known information about any particular operation, so that an analysis of the data will enable the "cost reducer" to put his fingers on the cause of the excessive cost. A foreman who knows that a piece costs so much, but is unable to satisfactorily explain why this cost is necessary, may have other good qualities to make him appreciated, but it is hard to imagine any compensating charms for an equally uncommunicative cost system.

The following method of accounting was devised to furnish the fullest possible information about every operation, on every piece, in a machine containing some 1,500 pieces. These machines were to be built in such large quantities that no possible saving was unworthy of attention. So well, however, did the system meet the demands upon it that those who have used it believe that it would be quite as successful upon a scale much smaller than the one for which it was designed. What was essential in this case is desirable under any circumstances—that all information about any piece be instantly accessible and that the cost of obtaining and collecting this information be considerably less than its value. This result, the maximum efficiency with the minimum cost, is, without doubt, best supplied by a system requiring no posting or transfers of any kind. During the first year it was in operation this system reported an average reduction in cost of manufacture of over 35 per cent., and while this result was of course due to the earnest and intelligent effort of the foremen in charge of the work, it can hardly be denied that some portion of this success was due to the cost system that pointed out the weak places and directed this effort into the most productive fields.

One of the most important points in cost reduction is to be sure that work will be done in exactly the manner that careful consideration has shown to be most advisable. To ensure that no point in the pre-determined method of machining the various pieces was overlooked, a service card was made out for each operation.

GROUP *F* PIECE *600* JOB CUT *4.2* MATERIAL CARD *F1 B* SERVICE CARD

3000-4-'01. P. CUT	LIMITS	INSPECTION GAUGES
Finish milling guide for line carriages.		

Parallel with Cut 2 to .002
" " " 3 " .002
#5 B. & S.

CUTTERS	JIGS	PUNCHES	GAUGES	SMALL TOOLS 4-19-'02 O.F.
M 4-6-8-4-2	*439 M*		*4057*	*Arbor #1146 M. Drawing in bolt #1147 M*
				Belts on pulleys B & D. with 2nd back gear.
				Transposing gears 23 & 63. Gear on hook joint shaft 27. & intermediate shaft 62.

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FIG. 1. A SERVICE CARD WITH SAMPLE ENTRIES. ACTUAL SIZE, 4½x7 INCHES.

GROUP *F* PIECE *600* JOB CUT *6* MATERIAL CARD *F1 B* SERVICE CARD

3000-4-'01. P. CUT	LIMITS	INSPECTION GAUGES
Drill, ream, face and counterbore, except for bolts to hold pump-trip latch and tap for bolts to 510	*Test reamed holes with standard plug gauges. Thickness from top surface to counterbored faces on bottom side — 2 19/32 to 2 39/64. Test threaded holes with standard male thread plug gauges. Test counterbore on lug for cover plate + or −.005 other counterbored holes for depth to scale.*	

6-19-02 O.F.

CUTTERS	JIGS	PUNCHES	GAUGES	SMALL TOOLS
	491 M		*1/4*	*1625 M with #6 & 13/32 teats. C bores 1619 M and*
			1/2	*1623 M. #6 extension drill 1181 M. Facing bar 1312 M*
			9/16	*Taps 1599 M. 29/64. C, P, N, 9/32, 7/16, 33/64, 5/8, 9/16,*
			5/8	*3/8, 23/64, 1/2, 9/16, R. 39/64 & 31/64, drills. 13/32, #6, 1/4,*
			Plug	*23/64 Special length drills. 1 1/2 & 1 3/4 C-bores with 5/8*
				tap teats. 5/8, 9/16, 1/4, 1/2, & 5/8, rose reamers. 1/4 & 9/16
			5/8 11 th'd.	*Special facing bars. 1/4 C bore with tap teat.*
			plug.	

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FIG. 2. ANOTHER SERVICE CARD WITH SAMPLE ENTRIES.

This card, in connection with the drawing, told the workman just what he was to do, what points to be careful about, what accuracy and finish were necessary, what special tools and test gages were provided and what standard tools, drills, reamers, etc., were required. In short, it gave the workman in writing, so that he could not forget, all the information that

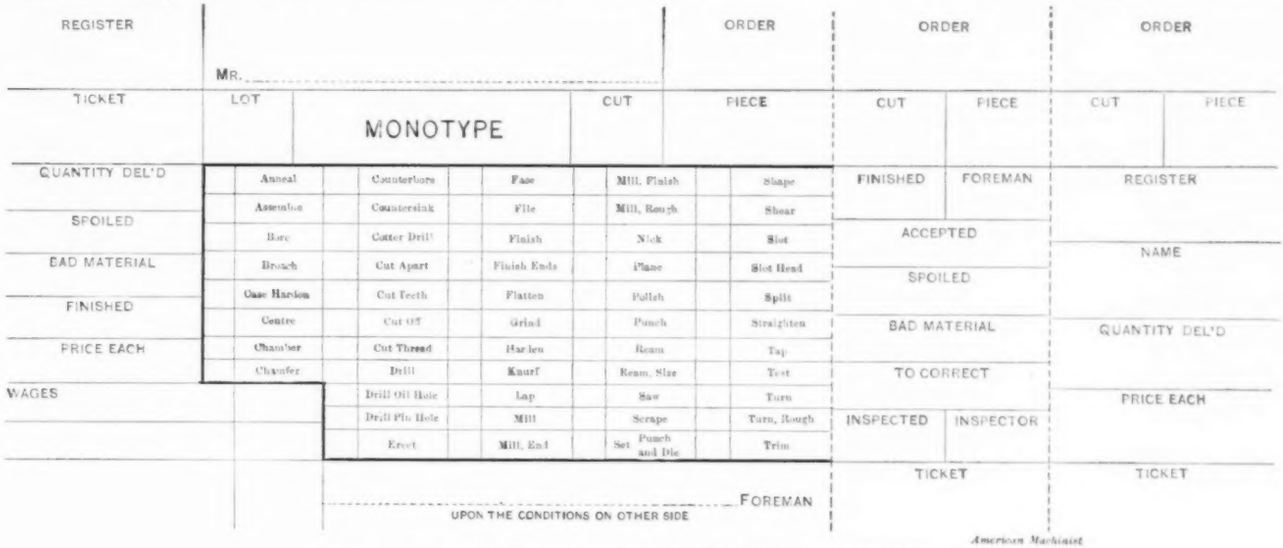

FIG. 3. FACE SIDE OF TIME TICKET. ACTUAL SIZE, 3¼x7½ INCHES.

the best foreman with plenty of time at his disposal could give him; for a service card never forgets, never is in a hurry, and, furthermore, never takes a day off and never resigns.

These cards are given to the workmen as needed, in tin cases with glass fronts. Should the foreman wish to change the

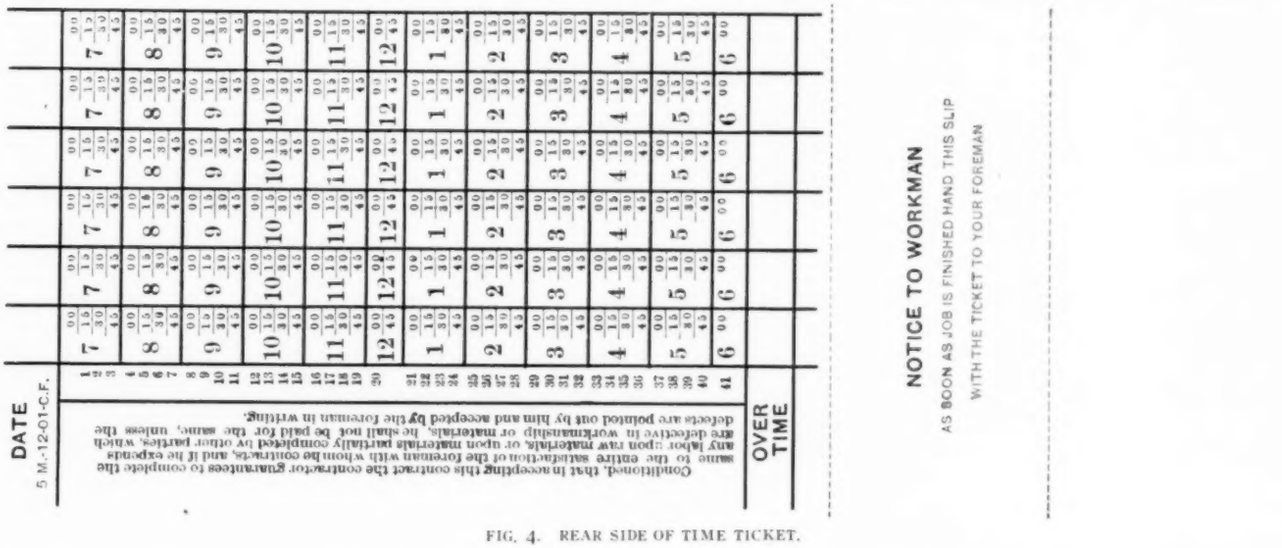
DATE
5 M.-12-01-C.F.
OVER TIME
Conditioned, that in accepting this contract the contractor Guarantees to complete the same to the entire satisfaction of the foreman with whom he contracts, and if he expends any labor upon raw materials, or upon materials partially completed by other parties, which are defective in workmanship or materials, he shall not be paid for the same, unless the defects are pointed out by him and accepted by the foreman in writing.
NOTICE TO WORKMAN
AS SOON AS JOB IS FINISHED HAND THIS SLIP
WITH THE TICKET TO YOUR FOREMAN

FIG. 4. REAR SIDE OF TIME TICKET.

method prescribed or add a caution, he takes the card from its frame and adds his memorandum in pencil. When the card is returned to the toolroom it is referred to an excellent mechanic, who has authority to pass on the suggestions. Should he approve of them, he changes the card in red ink or writes a new one.

Two specimen cards, with sample entries, are shown in Figs. 1 and 2. It should be noted, however, that the form shown was adapted to the drawings used during the development of the machine with which the manufacture was begun. These were good and clear, but showed several pieces on the same sheet. For this class of work my preference is for small drawings in which each sheet shows but a single piece. For such drawings the form of the card would be suitably modified and drawing and card would be issued with the drawing mounted at the top of the card, thus giving the workman all the information needed for doing the work.

Not the least advantage of the service card is that it reduces the writing of tickets, or piece-work contracts, to the minimum. Since the operation is fully described on the service card, it is only necessary to indicate it on the ticket, and this is done by marking a cross to the left of the required operations on the printed list (see Fig. 3). The rest of the tickets, which are prepared for all pieces before any work upon them is started, is filled in with rubber stamps, a speedy and accurate method, for it ensures that the same entry be made on all tickets.

One adjustable stamp is set with the number of the order upon which the work is to be done, a second with the number of the piece, and each ticket and its two stubs are stamped with these numbers. With a set of hand stamps numbered from one to nine, the lot number—that is, the number of times the piece has been made—is stamped upon each ticket and the consecutive number of the "cut" or operation is stamped upon each ticket and its stubs. In addition, the tickets were numbered consecutively, and, while this was probably unnecessary, those who have introduced new book-keeping methods will not criticize excessive precautions at the start. The quantity of pieces delivered is entered upon the outside stub and ticket for the first operation upon the piece, and, after the previous price paid for this operation has been noted upon the same stub, the ticket with the stub attached is sent to the foreman who is to have this work performed.

The tickets for all other operations upon the piece are held in the shop office, filed by piece numbers.

As soon as work upon an operation is started the foreman notes the workman's name and number upon both stub and ticket and enters the price each upon the ti ket. If this price be different from the one previously paid he alters the stub to correspond, and, in any case, at once sends the stub to the shop office. The shop clerk can therefore tell instantly by reference to these notifications that work had been started, the condition of every piece "in work." The workman reports his time upon the back of the ticket, Fig. 4, entering at the head of the left-hand unused column the date and indicating the time of starting and stopping by making a pencil mark through the time unit, in this case the quarter hour nearest these times. Referring to the column of consecutive numbers, at the left of the ticket, subtracting the figure opposite the time of starting from that opposite the time of stopping, at once gives the number of quarter hours worked on this ticket. A workman finds it much easier to report his time in this way, measuring it, so to speak, with a two-foot rule instead of a clock, for he knows that when the starting time on one ticket coincides with the previous stopping period he has not failed to report his entire time for the day.

All calculations were based upon the smallest unit of time, the quarter hour. For example, a man was paid six cents per quarter, not twenty-four cents per hour. Not only does this obviate the mistakes that are likely to occur with fractions, but it also saves time in writing. To express forty-one quarters requires two figures, the same amount of time expressed in hours, 10¼, requires four figures and a dash.

When he receives a ticket the workman gets the service card and drawing for that operation, identifying them by the piece and cut number, and all tools and fixtures. If, after reading his directions carefully, he does not understand what is required, he takes the card to his foreman. Considerable experience shows that the best results can be obtained by the latter opening the conversation by saying: "Can't you understand English? Listen." And then reading the card to the man. In this way the foreman refreshes his memory and the workman has no reason to suspect that his "boss" cannot tell him instantly, "out of his head," the best possible way to perform that operation, the exact limits of accuracy, all tools, special and standard, required, as well as the proper speeds and feeds.

When the job is completed the foreman approves the ticket and second stub by punching them with a conductor's punch, a time saver, since one can punch as well standing as sitting and the radius of action is not limited to a desk. The stub goes with the work to the inspector and the ticket is sent to the shop clerk, who holds it until he receives the stub, filled in and approved by the inspector. It will be noticed that this stub gives the inspector no clew as to who produced the work; it tells him only that so much work is to be pronounced good or bad. When defective work can be corrected the pieces to be altered are returned to the department foreman and the stub held by the inspector until the required corrections are made. When this is done the inspector punches it and sends it to the shop clerk, who enters on the ticket the quantity finished, the number spoiled by the man, the number defective through bad material and the wages due, and then sends to the proper department the ticket for the next operation. Thus the foremen have before them only the tickets for the work they can and should be working upon and the tickets serve as a report to them of the condition of their business.

The pay-roll is made up from the pay sheets, Fig. 5, which are punched at the top and kept upon arch files, arranged according to the register number of the workmen. In order that a sheet may be quickly found, by ruffling the neighboring sheets like the pages of a book, the workman's name and number are inserted at the bottom, instead of, as is usual, at the top of the sheet. At the top of the columns headed with the days of the week, space is provided to enter each day, the total time made as reported by the time clock. Below this the timekeeper enters the time made each day on the various tickets opposite their respective numbers, which are noted upon the sheet when time is first reported upon them. The sum of these entries must, of course, check the entry from the clock at the head of the column. Total time and wages on finished tickets are entered in either the day or piece-work columns, the multiplication of day-work time by rates being read from tables. These tables were arranged with the varying rates per quarter hour in the left-hand column, while opposite these were placed the amounts of wages that would be made in the different time intervals noted above these columns at the top of the table. For greater convenience these tables were mounted upon cylinders capable of rotation about a horizontal axis. A bar attached to the frame and held close to the cylinder was marked with the different numbers of quarter hours, and this bar was so placed in relation to the cylinder, that the varying amounts of wages that might be made at different rates, in, for example, fifty-seven quarter hours, passed under the figure fifty-seven on the cross-bar when the cylinder was revolved. To multiply 57 quarter hours by 5.7 cents per quarter, it is therefore only necessary to rotate the cylinder until this rate appears above the cross-bar; the result can then be read above the figure 57 upon the bar.

The accuracy of each pay sheet is checked, at the close of the pay, as follows: The total time for the week, as reported by the clock, is entered at the top of the sheet, and this must equal the sum of the time entries in the day and piece-work columns, while the total day-work time, multiplied by the rate per quarter hour, must equal the sum of the day-work wages if the different cross multiplications have been made correctly. These checks, however, do not provide for perhaps the most common error; for a

MACHINE SHOP.

10000—11-01 P.

CHARGE		Time on unfinished tickets brot forward.	SUN.	MON.	TUES.	WED.	THURS.	FRI.	SAT.	Total Time	DAY WORK		PIECE WORK	
No. of Order	No. of Ticket									Unfinished Time	Wages	Time	Wages	Time

RATE	Frac. Rate	FOREMAN	DATE	NAME	NUMBER
			190		

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FIG. 5. HEADING OF PAY SHEET. ACTUAL SIZE, 8½x9 INCHES.

man will frequently write an amount correctly upon the sheet and, in entering the same amount upon the ticket from which costs are made, transpose the figures and write an entirely different amount. To avoid this error and ensure that the sum of the tickets would, without hunting for mistakes, check the pay roll, the entries in the day-work and piece-work columns were made with two stylographic pens, held together with rubber bands in such a manner that whatever the lower pen wrote upon the sheet the upper pen duplicated, about a half inch above this entry, upon the ticket which was placed upon the sheet for this purpose. If then while adding piece-work tickets, in making up

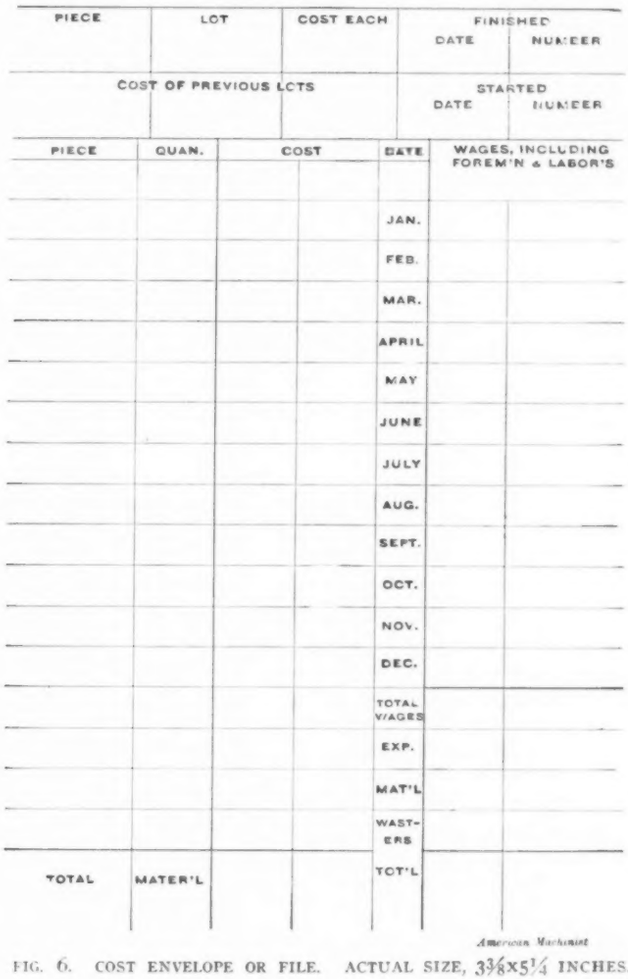

FIG. 6. COST ENVELOPE OR FILE. ACTUAL SIZE, 3⅜x5¼ INCHES.

costs, a ticket is discovered with the amount written by the duplicator different from the amount filled in by the shop clerk, it is instantly shown that this amount has not been correctly transferred to the pay sheet and the pay sheet is immediately corrected. The mistake that the duplicate pen does make is that it shows up errors so quickly and surely that its users, after a time, become so careful that the pen runs the risk of losing its job. Fortunately for it, by that time it has been found to be, with practice, almost as convenient as a single pen, and so its enemies are few.

When the men have been paid for these sheets they are filed vertically, behind separator cards, a card for each workman. With this arrangement no book or other form of pay roll is necessary or desirable, for all possible information about any employee is found upon the sheets behind his card. The other portions of the sheet are details not necessary for a general understanding of the system.

Instead of a cost sheet or book, an envelope, Fig. 6, is used for making up the cost of the various pieces, and in this envelope are placed the finished tickets for all operations upon a piece. When a set of tickets for any piece is made out, the envelope for this piece is also prepared. In addition to the piece, lot and order number, the date work was started and the quantity of pieces ordered, the envelope also gives the cost of earlier lots of the same piece taken from the previous envelopes. When a lot of pieces is finished, if the cost of each of these pieces, entered at the top of the envelope, shows too high, within the envelope may be found the tickets, or vouchers, for every wages payment upon the piece. A comparison of these tickets with those filed in the previous envelope for the same piece shows exactly where the increased cost occurred, what man did the work, the foreman who approved it when it was done, the number of pieces condemned for bad work and for bad material. When it is considered that this information is obtained without the expense or liability to errors due to copying, and that there is no excuse for this information not being up to date, since all that is required is to put the tickets in their proper places, the value of the envelope system may be appreciated.

A refinement not usually required, but in this case necessary for commercial reasons, was the making up of the absolute wages cost of each piece—that is, to the wages of producers was added the proper proportions of the wages of non-producers, foremen, clerks and laborers. This is done by determining, at the end of the month, a percentage rate which will distribute exactly on each dollar of producers' wages the wages for the month of the non-producers. When the rate is determined the tickets are taken from their respective envelopes, added with a comptometer, and this result multiplied on a slide rule by the percentage rate. The total wages—that is, the sum of producers and non-producers—are then entered upon the face of the envelope with the date; the sum of these entries, of course, checks the total pay roll. When a piece is finished, below the total wages on the envelope is entered the proper proportion of expenses and the value of all material and wasters used, as reported by the store-room. The total of these items gives the cost of that lot. All material, whether raw or finished, delivered to make a piece is entered, when delivered, in the left-hand column of the envelope. Inasmuch as finished pieces are frequently issued to combine with other pieces to make parts, the form provides that the quantity and number of such pieces, as well as their value, may be entered in the material columns. Pieces required to replace those spoiled in such combinations are only issued by the store-room upon the presentation of a memorandum order approved by a foreman, and these memoranda with the value of the material noted upon them, are filed in the proper envelopes, and when the pieces are finished the total value of such wasters is noted on the face of the envelope as stated. Frequently an examination of the material or waster items will show at once the reason for excessive costs.

To insure that no tickets be missing when the cost of a piece is made up, upon the back of the envelope is entered the numbers of all tickets issued for that piece. Since the tickets are written at the same time and numbered consecutively, it is only necessary to enter the first and last number of this series, unless during manufacture it is found necessary to take additional cuts, and space is provided for the numbers of such tickets.

All material, whether raw or finished, is carried upon stock cards, Fig. 7, a card for each item. These cards, in addition to the name and number of the piece, give its location in the store-room and the max-

imum and minimum quantity desirable to carry. When the quantity on hand is reduced to the minimum the shop clerk at once orders enough to bring it up to the maximum. When any material is received the date is entered upon the proper card, in the left-hand column, and the quantity, value, and the rate at which it is to be issued are noted in the received section of the card. To any material already on hand, as shown by the entry in the "On Hand" column, at the right, is added the amount of this material received. When material is delivered, the date is entered in the date column, and in the delivered section of the card is noted the quantity delivered, the charge or order upon which it is issued, and its value. If the material is used to make groups—that is, one of the sections of the finished machine, or for the finished machine itself—the value is entered in the third column of the delivered section. If issued for repairs it is entered in the fourth. From the amount on hand the amount delivered is deducted, so that the last entry in the "On Hand" column shows at once the quantity in the storeroom, and this quantity the storekeeper is expected to be able to produce. Too much importance can hardly be attached to the value of this daily balance. It does away entirely with the necessity for an annual inventory, for it substitutes for it a daily one. Occasionally, not at stated intervals, a few of the articles in the storeroom should be counted, to see that the quantity on hand tallies with the card and the accuracy of this account should be insisted upon.

Piece

SECT'N SHELF BIN MAX. MIN.

Date	RECEIVED		DELIVERED				On Hand
	Quan. Rate	Value	Quan.	Charge	Groups Erect	Repairs	

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FIG. 7. HEADING OF STOCK CARD. ACTUAL SIZE, 4½x7 INCHES.

As there is always liability of errors in a single-entry system of bookkeeping, no system can be regarded as satisfactory that does not provide for the interchecking of accounts. At stated intervals the stock cards should be balanced. To the value of stock of any pieces on hand at the end of the previous period, should be added the value of any material received during the period. From this sum of the value of the "Material Received" column should be subtracted the sum of the "Groups" and "Repairs" columns. The result is, of course, the value of the stock of that piece on hand. The total of these items for all pieces taken on a comptometer gives the value of the finished stock being carried. The sum of the "Repairs" column should check the total value of material billed on repair orders for the corresponding period. The sum of the "Groups" column and the value of all raw materials issued, taken from the material cards, should equal the sum of all material entries on the envelopes for the same period. The sum of the values of all envelopes for pieces finished during the period should equal the sum of all entries in the "Value" column of the received section of the cards.

In what must of necessity be but a brief description, a close examination will show that, in some details the foregoing explanation is not complete. As these details, however, vary so much for different plants they are hardly of importance enough to warrant description here.

It is so evident that but little of this system is original that it is best to own up that "I have gathered a posy of other men's flowers and only the string that binds them is mine own." But inasmuch as this stealing has been productive of such good results in one case, this "little bit of string" is offered to those who are interested in, and appreciate the importance of, factory cost systems that enable one to do more than write price tags for finished goods. While it is never pos ible to transfer a system bodily from one plant to another there are a few points in the above that those who have known their advantages would find it difficult to do without.

First on this list must be placed the service card. No matter what they cost or whose time it takes to get them up, no plant running on accurate, duplicate work can afford to be without them. Neglect entirely the time they save and they are still necessary as insurance against the loss of men in whose heads is often filed the only existing copy of valuable information. The envelope system for filing related data has proved a satisfactory solution of the problem of preserving, in convenient shape for quick future refere ce, masses of original records of details. Those who have used a stock record that shows at a glance the quantity of each article on hand will appreciate the advantages of a system that gives also the value of each piece and which enables the total value of stock on hand to be so easily obtained. Finally the precautions that have been taken to, first, avoid mistakes, and second, to check the unavoidable ones, are a necessary part of any shop cost system. At the best, the shop clerk is subjected to interruption and distractions that his brother in the office knows not of. It is, therefore, of the highest importance that he be obliged to spend as little time as possible on the soul wearing process of hunting for mistakes. He should be supplied with adding machines, slide rules and any tables that contribute to his speed and accuracy. I have referred to him as a non-producer, but I hasten to assure him that this was in the Pickwickian sense only, for I have learned to know that he, and the data he supplies, play no small part in the solution of the problem of reducing costs.

A Bending and Forming Die.

BY C. H. ROWE.

The piece to be formed, Fig. 1, is soft aluminum, .050 inch thick. We first blanked it out and then as a separate operation cut out the middle and pierced the small hole near the end. It was necessary in this case to handle the work twice to produce the perfect blank, as the limited size of the press would not permit the successful operating of a die of the size to combine the cutting and piercing and complete the blank at one stroke. Fig. 2 shows the result of the bending.

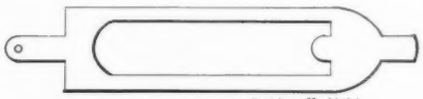


FIG. 1. THE BLANK TO BE FORMED.

Fig. 3 shows the die, which consists of three principal parts—*A*, the base or bolster; *B*, the die, and *C*, the spring-supported pressure plate. *A* is of cast iron planed all over, and to it is secured by screws and dowel-pins the tool-steel forming die *B*. After machining the die all over, the oblong hole for performing the bends on the work and, for admitting the plate *C*, was finished to size. The edge around the top of the hole was given a small highly finished round to obviate any possibility of scratching or cutting the blank when pressed down into the die. At *D* we planed below the surface ⅛ inch, as shown by the dotted line in the side view,

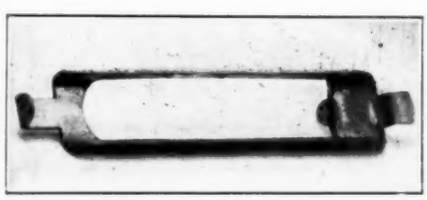


FIG. 2. THE FINISHED PIECE.

to form one end of a wing on the blank horizontal and parallel with the main part, after it was elevated the required hight, about 3-16 inch. After drilling and counterboring for the screws *E*, dowel-pins *F* and the six blank-locating pins *G*, the die was hardened and slightly drawn to release any strains caused by the sudden cooling. The under side was ground just sufficient to make an even fit on the base *A*.

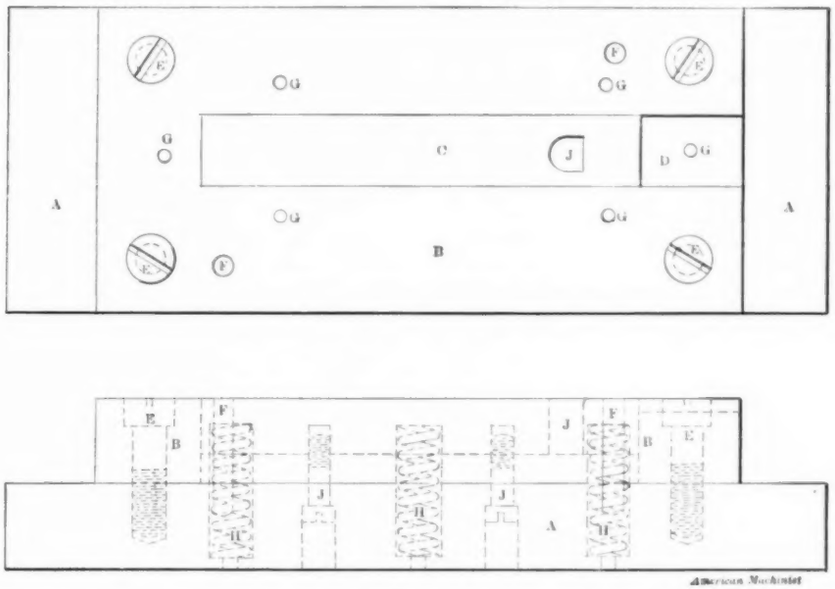


FIG. 3. A BENDING AND FORMING DIE.

The three springs *H*, made from 3-32 inch steel wire, support pressure plate *C*. This plate is checked on its upward movement at a level with the surface of the die *B*, by two screws *I*. Hole *J* is worked out to receive the tongue on the blank that is turned down by a fixed piece on the punch. The drilling and counterboring for the screws and springs having been done, the plate was hardened by dipping in an oil bath and afterwards drawn to a medium straw color and then surfaced top and bottom on the grinder. The parts were now assembled and pins *G* were driven in so that their ends projected about ⅛ inch above the die to conveniently guide the blank.

Fig. 4 shows the punch. *A* is the cast-iron holder. After finishing it to size we drilled and counterbored for the two ⅜-inch screws *B* which regulate the amount of movement of punch *C* from holder *A*. This punch is made of tool steel with the right corner cut away to conform to the shape of the die and to form the end of the blank. The hole was drilled and filed straight through to an easy fit around the punch *D*—that is, fitted snugly into holder *A* and retained firmly by the taper pin *E*. The parts were next temporarily assembled in proper relation, and twelve holes were drilled with a No. 18 drill through holder *A* and spotted into piece *C* for springs, and also the holes were marked for the two screws as shown. Punch *C* was removed and the holes were counterbored ⅛ inch deep to receive and retain the springs, one of them being shown at *F*, and drilled and tapped for the screws, and then hardened and ground and permanently assembled.

When in operation the blank is lubricated by oil or soapsuds and placed on top of the perfectly flat die, inside of the guide pins *G*. The press ram travels downward and the punch *C*, Fig. 4, engages the work and forms it down until plate *C* of the die brings up on base *A*. Continuing the downward stroke, the punch *C*, Fig. 4, brings up against its holder *A* with sufficient force behind it to set the blank and form it as shown; simultaneously punch *D* projects and bends down the tongue of the blank into hole *J* in the die. The finished work is released from both punch and die by the action of the springs on the upward movement of the press ram. The tendency of the punch *C* is to maintain a rigid resistance until the plate *C*, Fig. 3, reaches its downward limit and rests evenly on the face of base *A*; consequently the number and size of the springs in the punch must vary according to the nature of the stock and the force required to form it.

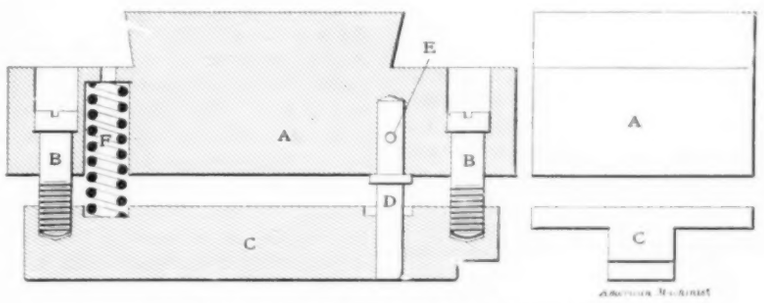


FIG. 4. PUNCH FOR BENDING AND FORMING DIE.

Tests of Ball Thrust Bearings.*

BY THOMAS GRAY.

This test was made on samples of the thrust bearings supplied commercially by one of the manufacturers in this country. The race consisted of two hardened circular V-grooves 1.5 inches mean diameter. Between these grooves twelve ⅜-inch balls were placed to complete the bearing. The results are shown in the following table:

Lubricant.	Speed in R. P. M.	Moment in inch lbs.	Limiting Value of Pressure, p.
Dry	160	$.063+.0026\,p$	400
Vaseline .	162	$.125+.0021\,p$	. .
Machine oil	160	$.031+.0025\,p$	500
"	96	$.063+.0026\,p$	550
"	60	$.094+.0027\,p$	. .
"	36	$.112+.0028\,p$	. .

TESTS OF BALL THRUST BEARINGS.

The first column gives the lubricants used. The vaseline was the ordinary yellowish variety sold by druggists for toilet purposes. The machine oil was of medium density. The second column gives the speed in revolutions per minute. The third column gives the moment of resistance to rotation offered by the bearing. In this column p stands for the total pressure. The fourth column gives the limiting value of p for which the formula in column three is applicable. Above this pressure the resistance to turning increased more rapidly, showing signs of cutting. Where no pressure is stated the limiting pressure was greater than 800 pounds, which was the greatest load applied.

The method of experiment was to mount two bearings back to back on a spindle through which the pressure was applied and also rotation of the front halves of the races produced. The pressure was transmitted to the platform of a steel-yard through a third bearing. The moment required to prevent rotation of the two back halves of the races was measured by a spring dynamometer and half of that moment is given in the table.

The moment is practically proportional to a constant plus a simple multiple of the pressure up to a certain limiting pres-

*Abstract of a paper read before Section D of the Pittsburgh meeting of the American Association for the Advancement of Science.

sure which is smaller the higher the speed.

The constant term depends both on the lubricant and the speed. It is high for a dry surface or a heavy lubricant and higher the lower the speed. It is to be noted, however, that for heavy pressures the heavy lubricant has a decided advantage.

Experience With a Simple Babbitt Testing Machine.*

BY E. S. FARWELL.

Among the problems I have been called upon to investigate during the past four years was that of the proper bearing metal for different conditions. It seemed probable that a babbitt which gave good results in a certain bearing in one mill would give equally good results in similar bearings in other mills. In order to establish a starting point for our investigation, we wrote to each superintendent for a report on the experiences in his mill. A chemical analysis was made of the various metals recommended, when it developed that metals apparently giving widely different results in use were of the same composition. It was then decided to make friction tests of these various babbitt metals. A manufacturer of anti-friction metal kindly loaned us his testing machine, which, with the improvements made upon it, it is my purpose to describe.

Fig. 1 shows the machine as it was received and used in the first series of tests. It has an arbor or mandrel 3¼ inches in diameter and 2½ inches long, running on a 2 3-16 inch shaft. The bearings for this shaft were ordinary babbitt lined pillow blocks, 7 inches long. The block to be tested was held against the bottom of the mandrel by a lever, on the outer end of which additional weights were placed to increase the unit pressure. The receptacle beneath the mandrel was filled with oil to such a depth as to immerse the test block and the lower part of the mandrel. The test block, shown in Fig. 2, is cast in a mold and has a raised bearing surface ¼ inch wide as shown. This allows the experimenter to see the instant when the metal begins to run, which is noted as the time of failure. The speed of the mandrel was maintained as nearly uniform as possible at about 775 revolutions per minute. A series of nineteen tests on twelve different metals was made with this machine, with some rather surprising results. The machine was started with a pressure on the test block of 200 pounds per square inch, and this unit load was increased every ten minutes by a 200-pound increment. The temperature of the block was read every five minutes. The entire pressure upon the test block was transmitted to the cap of the bearing next the mandrel. Although the area of test block in contact with the mandrel was only 1½ square inches and the pillow block was 7 inches long, it was almost impossible to keep the latter cool. The heat thus generated was undoubtedly transmitted along the shaft to the mandrel and test block, and hence entire confidence cannot be placed in the thermometer readings. This cap failed three times. For the first five tests, following the instructions of the owners of the machine, the blocks were applied just as they came from the mold. But in all other tests they were carefully scraped to a fit before starting. With this single change in treatment the same metals were able to stand up under loads ranging from 12 to 50 per cent. greater. The greatest unit pressure observed on a genuine babbitt was 2,200 pounds, although one block, which it was thought had failed at this pressure, was found, when taken out, to be in perfect condition. The temperature at failure was 202 degrees. We were very much surprised to find that a mixture of our own containing about 81 per cent. of lead, 12½ per cent. of antimony and 6½ per cent. of tin, on three different tests withstood a higher unit pressure. In the first of these three tests the anchor bolts of the machine gave way after running four minutes under the unit load of 2,600 pounds at the temperature of 180 degrees. The test block was still in perfect form. In the second test the test block failed after running four minutes with the same unit load, at the temperature of 182 degrees. In the third test the shaft bearing failed after running three minutes with a unit load on the test block of 3,200 pounds. The temperature had been between 180 and 190 degrees for forty minutes. Three minutes before the end it rose to 197 degrees and at the end to 202 degrees. The test block was found to be in perfect condition. This high temperature undoubtedly had its origin in the main bearing, and not in the test block.

It was apparent to us that the temperature readings were not to be relied upon as indicative of the friction generated by the test block, since the heat from the main bearing added a greater or less increment in each test. It seemed that the bath of oil must favor that metal which would the more readily dissipate the heat into the oil. This method of lubrication is neither common nor often practicable, and is therefore not the condition which should obtain in tests such as we were making. It was then decided to rebuild the machine to, if possible, overcome the objectionable conditions which had been encountered.

The rebuilt machine is shown in Fig. 3. The same shaft, mandrel and test blocks were used. Two duplicate levers were used. They were made of round bar iron, 2 13-16 inches in diameter, and held two test blocks against opposite sides of the mandrel. The short ends of the levers were held together by a knife-edge clevis, and the long end of the lower bar rested on a knife-edge on platform scales. Exactly over this latter point provision was made for applying additional weights. In order that the pressure on the two blocks should be the same and no pressure be transmitted to the main bearing, it was necessary to provide a support for the end of the bars near the mandrel. This was done by a cable passing over two pulleys to a weight. Although there is no movement to be transmitted, it would probably have been better had we used a lever with knife-edge bearings.

By referring to Fig. 4 the action of the forces may be more easily seen. Each lever weighed about 90 pounds, producing an initial pressure on the blocks of 405 pounds, or 270 pounds per square inch. The counter weight supported 90 pounds, leaving 90 pounds to be supported and weighed on the scales. The exact amount to be counterweighted may be determined by blocking the levers apart free of the mandrel and balancing them. Since the point *A*, where the weights are applied, is directly over the fulcrum *F* on the scales, no amount of loading will disturb this equilibrium, but will increase the pressure on the test blocks and the weight on the scales. Scales were preferred to spring balances, as it was desired to limit the actual movement of the mechanism in order to maintain the alinement and equilibrium. The scales will weigh, besides the initial load of 90 pounds and the weights applied at *A*, the friction of the mandrel on the test blocks. This will be plus or minus, according to the direction of rotation of the mandrel.

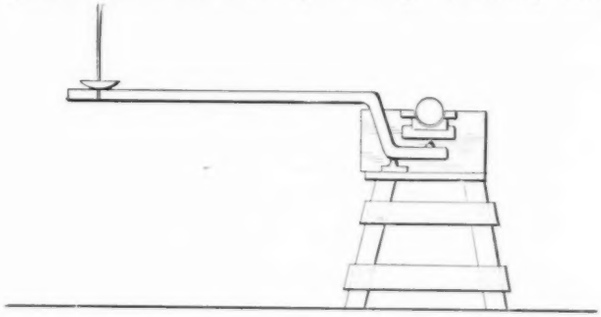
The uniformity of lubrication next claimed attention. We found what Mr. Tower has said to be true, that "the friction may be anything between the oil bath results and seizing, according to the perfection or imperfection of the lubrication." One method tried was perforated pipes dropping oil on both sides of the mandrel its entire length. It was hard to maintain uniform lubrication by this method, and it was discarded. Another method resorted to was by flooding—*i. e.*, to drill into the hollow square of each test block and keep this receptacle filled with oil. This did not give equal lubrication on the longitudinal and girth bearing surfaces, and the results proved erratic. It did not in any way approximate any practicable method of lubrication of ordinary bearings. Still another method was by saturated pads fed by the perforated pipes and bearing against the sides of the mandrel. If kept well saturated this should give good and uniform lubrication.

With this machine the genuine babbitt mentioned above as standing 2,200 pounds unit pressure without failure, failed at 1,080 pounds when lubricated with the saturated pads, receiving seventeen drops of oil per minute, and at the same pressure when lubricated with the hollow square flooded and receiving thirty-eight drops of oil per minute. When lubricated from the perforated pipe at the rate of forty drops per minute it failed at 540 pounds unit pressure. These are typical

* A paper read before Section D of the Pittsburgh Meeting of the American Association for the Advancement of Science.

results and clearly show the relative merits of the different methods of lubrication. All metals failed at lower pressure than when immersed in oil, showing that there was greater friction and more rapid heating. The results will be, however, more nearly those obtained in everyday practice, and with care to keep the pad equally supplied with oil in all tests, the relative merits of the metals may be determined. But without uniform lubrication all sorts of results may follow, and the best metals may be made to show very poorly in comparison with an inferior one. Our tests were not sufficiently extensive to establish many facts incontrovertibly, although fulfilling their primary purpose of indicating the metals which should be selected. While the lead base metals showed such good results, the conditions of the test must not be overlooked, viz.: uniform speed, uniform pressure and uniform lubrication. In many cases this is not the condition of service in the mill. Unbalanced pulleys, heavy gears and machines with rapidly reciprocating parts will pound the bearing so much as to preclude the use of lead in any quantity. This condition may be closely approximated in the testing machine I have described, by turning the mandrel slightly eccentric to the shaft. The result of such a construction I do not now purpose discussing, as it would be mere speculation. I may perhaps have an opportunity of carrying these experiments further and shall then incorporate that feature in the machine.

Our selection of metals based upon these laboratory tests, supplemented and interpreted by experience in that best of all laboratories, the mill, has proven very satisfactory, fully warranting the expense of the tests. Considering the reliability of the results which may be obtained with so simple and inexpensive a machine, there would seem to be little excuse for any mill to be in ignorance of the kind of metal best adapted to its work or to pay 18 cents per pound for a 7-cent mixture, as we found some of our mills were doing.



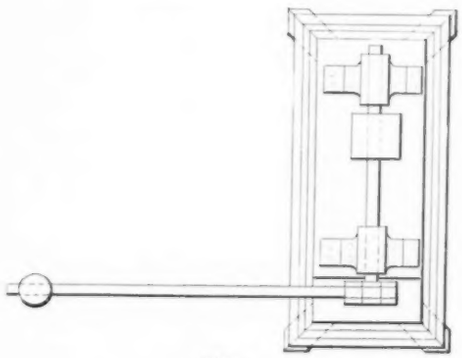


FIG. 1.

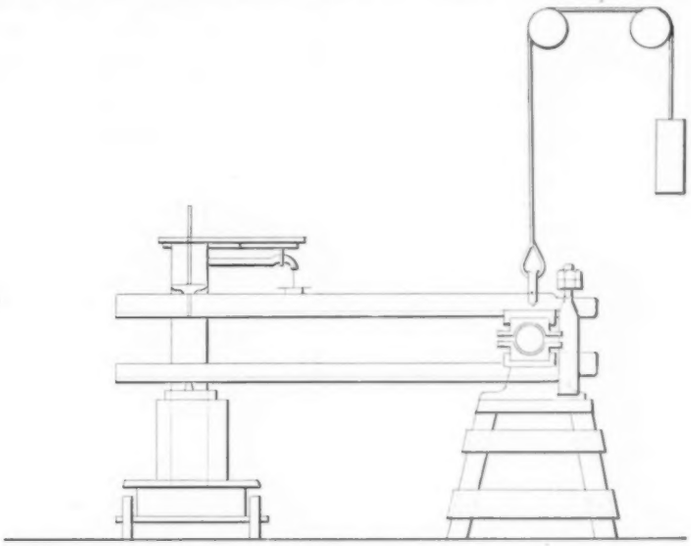


FIG. 3.

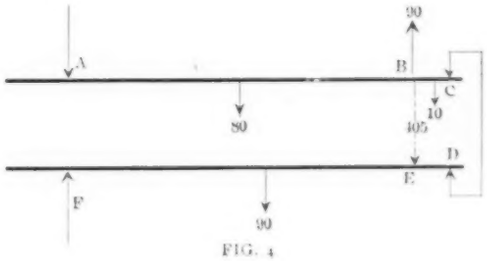
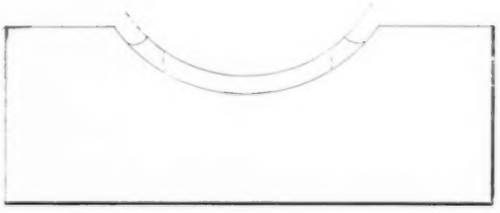


FIG. 4.



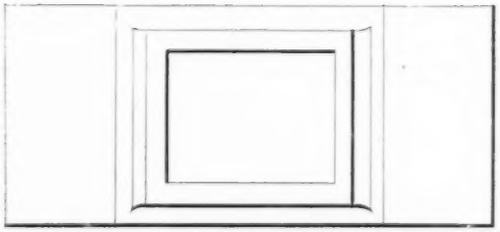


FIG. 2.

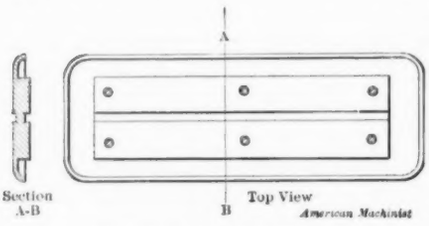
TESTS OF BABBITT METALS.

Letters From Practical Men.

Special Table for the Milling Machine.

Editor American Machinist:

The sketch herewith shows an extra table to be clamped to the regular table of the milling machine. We have a large number of milling machines of the Lincoln type, the tables of which were not designed to catch the oil, but allowed it to run over the working parts of the machine down into a pan on the floor. Various makeshifts have been used, but they are all being replaced by the new cast-iron table.



MILLING MACHINE TABLE.

H. T. G.

Depth to Which Sheet Metal Shells may be Drawn

Editor American Machinist:

Noticing Mr. J. D. Riggs' article on the working of sheet metal in dies, which was read at the Boston meeting of the American Society of Mechanical Engineers, in which he stated that the depth to which plain cups may be drawn equals one-half the diameter for small cups and one-fourth for larger ones, I wish to remark that what he says is not in all respects in accord with my experience. I have drawn (and am doing it every day) shells from .012 inch beaded brass ½ inch in diameter and 9/16 inch long in one operation. I also have drawn .015 inch soft, bright steel as long as the diameter up to about ⅞ inch, and over that size the average length would be considerably over one-half the diameter. I have also drawn brass shells 2¼x2¼ inches out of .040 beaded stock, and aluminum and zinc shells three-quarters the length of their diameter may be drawn by first warming the stock in a common drying oven and using a mixture of whale-oil soap and kerosene oil—about 1 part soap, 7 parts hot water and 2 parts kerosene oil, and kept as hot as possible.

Tin and hard black iron and steel will not stand as great a draw as bright steel, but it will average over one-half the diameter; and, in fact, I have made some very curious things out of hard, cheap stock where the cost of annealing would have taken the profits, and I got out of it by a little coaxing in the tools.

As for formulas for obtaining the diameter of a blank, I have had several, but none are infallible, and the good old-fashioned way of trying for your blank or weighing your sample is the best way to get a shell the proper length.

I have one formula, though, that proves very good on combination die work, and that is: the diameter of the blank will equal the diameter and one and a quarter times the length of one side, inside measurement. This will give sufficient edge for trimming. I hope this may be of value to your many readers and to Mr. Riggs.

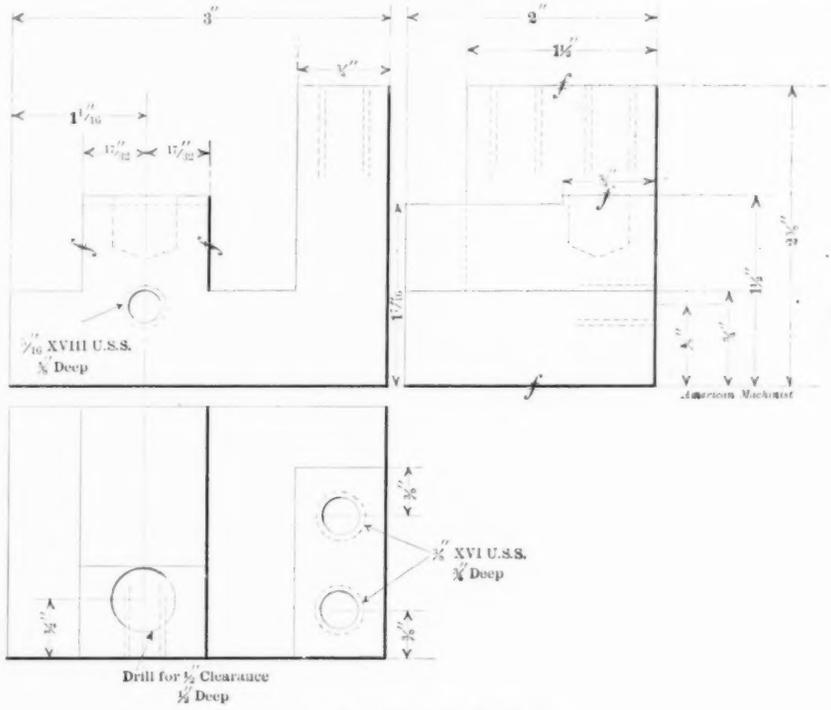
EXPERIENCE.

Finish Directions on Drawings.

Editor American Machinist:

I have read with considerable interest the different articles that have appeared from time to time for the last eighteen months relating to finish directions on drawings.

That one little word, "finish," or its representative, if given a fair show upon paper by the draftsman in such a way as to be thoroughly understood and made *plain* to those with whom it comes in contact, would do away with many of the mistakes that occur. In other words, the whole sum total of the requirements is *plainness*.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there they started a 10, 20 and 30 cent vaudeville show, and here is where little Johnny got himself disliked and the others into trouble. Little Johnny thought this a good chance to let Mr. Green see what a bright boy he was, and how well he was taking an interest in Mr. Green's business. So he at once made a bee line for Mr. Green and told him all that was going on. Mr. Green came into the machine shop and saw the *vaudeville* and inquired for the foreman. You can be sure the old "jours" did not know anything about him. "It was none of their business." When the foreman returned Mr. Green called him to the office and told him a thing or two, and gave him orders to discharge one of the machinists. All on account of little Johnny. He did not know enough, or was not instructed that it is a part of the trade to learn, to mind one's own business.

Boys, remember this: You won't learn your trade from the proprietor because Papa and he went to school together. You *can* learn your trade from the foreman and workmen in the machine shop. Learn to mind your own business. Know your place, be agreeable and accommodating to the workmen; don't get fresh. Keep your eyes and ears open and mouth closed, except when you want to ask proper questions.

H. B.

The Apprentice's and the Dervishes' Monkey Wrench.

Editor American Machinist:

At page 798 a correspondent describes "The Apprentice Boy's Wrench," which is certainly ingenious but not altogether new, as the Dervishes in the Soudan campaign of 1885 used precisely the same device for unscrewing the fish-plate bolts when destroying the railway.

T. G. TULLOCH,
Capt. R. A.

Royal Arsenal, Woolwich, Eng.

Bracing Up a Shop.

Editor American Machinist:

Fellows do say some strange and unaccountable things about me—not that I dislike it at all. Not long ago someone wrote to the AMERICAN MACHINIST asking about the limits of accuracy in boring pulleys and for some other information in that line. After waiting a few weeks and noting that no answers appeared, I offered a few remarks as to the reasons why the inquiry had been so unsuccessful. My idea was that the writer had not been as communicative as he should have been, and, asking about pulley boring, had not told how far he had already advanced in the pulley-boring line as a starter for the additional information sought. The purpose of my letter, and I thought the tone of it also, was distinctly encouraging, and yet "Dutch," at page 1022, says that "I jumped all over a fellow." If you saw me actually jump once, you would have different ideas about jumping.

I am decidedly glad to have such good proof that my letter did have the good effect which I intended it to accomplish as is given me in this letter of "Dutch," which is a model of its kind. As a narrative introductory to an inquiry, I am entirely unable to find any fault or defect or incompleteness in the telling of the conditions in the shop concerning which advice is sought, and if the letter does not elicit replies it will be for entirely different reasons from those which caused the failure in the other case. The job of bracing up a shop is a very different one from that of boring a pulley. There are hundreds of men who bore pulleys all right for one who can run a shop satisfactorily.

This letter of our friend "Dutch" I take to be a beautiful confirmation of the correctness of the suggestions in my former letter referred to. In that I said that if you want to know you should give the details as completely as possible up to the point where your inquiry begins. In telling us so clearly the details of the present condition of his shop, "Dutch" puts us at once on to one thing at least that he can do to make things better. He evidently needs a toolroom, with someone to look after it. He says: "Tools are not put back where they belong, taps are put away dirty, drills are left in their sleeves and sockets, toilet paper is strewn over the floor in the closets, etc." If that doesn't tell us in the first place that he has no toolroom, in the second place that he very much needs one, and in the third place that if he had one a large part of the troubles that he enumerates would disappear, then I don't know what language is for.

The same issue of the AMERICAN MACHINIST which contains "Dutch's" letter also calls attention to the use and abuse of the word "automatic." Lots of people have to learn that a toolroom is not automatic and cannot be made to be. It is all right to provide "a place for everything," and then it is easy to say "everything in its place," but the saying of it never insures that the thing will be there. This "Dutch" has sufficient evidence of, and he ought to take the hint. Shops of about the size of this one of "Dutch's" are just the ones where they have the trouble he complains of. When the shop has only two men, or at most three, it is easy to locate the negligent one, but with two dozen or more the case is different. These shops get to the point where they catch on to the toolroom idea, but they think they can't afford it. They finally get to the point where they have to afford it and then they at once find they can nevermore afford to be without it.

The toolroom I believe would get rid directly and at once of half of "Dutch's" trouble, and indirectly it would do more than that by changing the tone and habit of the shop. Getting all the tools not in use away from the benches and tools and floor would make the shop cleaner at once, and this would lead to a cleaner and neater standard in the minds of all the men. They would be led unconsciously to avoid some of their shiftless tricks and get into better ways. I am not at all sure that sweeping the shop twice a week is enough. I have seen shop floors swept every day, and I never knew them to be kept any too clean and orderly then.

About the closets, it is very essential that they should be cleaned every day and looked after all the time. One thing very necessary, and too often ignored, is that they should be light. They are often stuck into dark holes and corners that make it impossible for anyone to enter without suspicion, and then they are painted the color of dirt, when they ought to be painted white and kept white. It is the place that is dark and dirty and the suggester of dirt and disorder that will not be respected by the men.

In a general way, I do not believe at all in signs around the shop, except for necessary information. Posted rules with threats of punishment are conspicuously absent in the most successfully conducted establishments. The rules that you see in shops that merely think they try to have order and discipline are not enforced one time in ten and the men laugh at them.

You never can point out really all the tricks involved in securing and maintaining neatness and order in a shop. It is a matter of influence to a large extent. It is the quiet man rather than the blusterer that you generally find most able to secure it. The man must himself be correct and orderly and, after all, secure his desired results more by example than by the reiteration of formal orders. If we only knew "Dutch" personally, and could spend an hour or so in his shop, we would know a great deal more about it. From the very neat letter that he puts out, it is rather difficult to believe that his case is as bad as he thinks it is. He may be nervous and dyspeptic and his health may improve, and then the shop and the fellows may look better. At any rate he should get the toolroom, and all that it implies, and then write us another letter. I hope somebody else will have some opinions to express about his case.

TECUMSEH SWIFT.

Making Gas Engines Go.

Editor American Machinist:

I was once employed to erect gas and gasoline engines and to fix them when they lay down. From my experience in this last work I learned that many people regard this type of motor as a rather mysterious agency which may or may not work in a somewhat unaccountable fashion, following a law of its own. Hence a few words about the care of gas engines, and what to do when they refuse to run may not be out of place. I will assume that the engine has been properly erected.

First, be systematic about the engine; that is, in the morning oil up, see that the circulating water is on, see that your spark

is good, throw your switch and turn on the gas in regular order. This will make it more certain that all these points will always be observed. In the evening shut off the gas on *both* sides of the gas bag, so as not to burst it if the pressure rises. Throw the switch so that the battery will not be short-circuited if the sparking points happen to be in contact when the engine stops. Shut off the oil, drain the water pipes and jacket, if in winter, and wipe up—you may not have time in the morning.

Now, in spite of all ordinary care, it is quite likely that you will some days have trouble in getting the engine to run, in which case the proper thing to do is to find the trouble and then cure it. It may seem unnecessary to say this, but it isn't. Stop and think. Don't do anything at all if you haven't a reason for acting. I say this because in so many instances when there is trouble the poor engine is "adjusted" until it cannot possibly run without some of this emergency work being undone.

Try your compression. This will reveal the condition of the valves and rings. Generally a leaky valve is the cause of no compression, and if a valve leaks, regrind it. Don't use flour emery, and reverse your motion when grinding, so as to leave no scratches. A valve should be ground until the seat shows a good bearing. Sometimes a valve shows a shoulder at the top on grinding owing to its diameter being a little larger than that of the seat. File this all off so that it will certainly seat right, otherwise this shoulder may cause a good deal of trouble.

If the compression is all right, look to your spark. When the ordinary make-and-break device is used, the spark should be reddish and have considerable volume. A brilliant point is of no value, the spark must have size. This does not apply to the "jump spark," which is another story. If your spark is not all right, look to your battery and connections. The battery may be run down, or there may be a dirty or loose connection. If the spark is all right outside, look to the sparking points, for a good spark outside is no guarantee of one in the cylinder. A sparking point may be dirty or destroyed. I have seen one platinum point stick to the other and break off. They may not come together and separate right. They should strike firmly and break quickly. The insulated point may be imperfectly insulated. This is especially likely to be so if the engine misses fire occasionally. Mica is used a good deal as an insulator here, and it can be renewed cheaply. When getting the engine to spark right, be sure there is no gas in the cylinder. This is done by turning the engine over a number of times with the gas off. Also be sure the exhaust valve is closed, because you may clean the cylinder and fill the exhaust pipe with gas which a downward draft will carry through an open exhaust valve. A bad burn may be the result of neglecting this precaution.

When the spark is all right, see if the valves and ignition are timed right. The valve cams are usually fastened securely at the shop, but the igniter can generally be adjusted. It should fire a little *before* the end of the compression stroke. This makes the line on the card indicating increase of pressure straighter than when igniting on the center. If it fires too soon, the engine will thump at this part of the stroke.

If you still have trouble, look to your gas pressure. The gas bag will generally help you to detect any difference. If the gas pressure is very iregular at times, as it is in the gas belt, it may be necessary to use more cells. Also in winter some cells get too cold if care be not taken.

If you are using gasoline, look to your pump, for gasoline is next to the luminiferous ether to pump. You *must* have good check valves and piping. Sometimes the quality of the gasoline is not satisfactory, which can generally be detected by getting a gallon from some other source and comparing results.

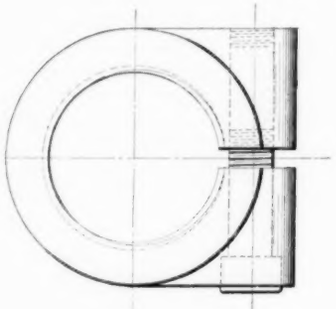

FIG. 1

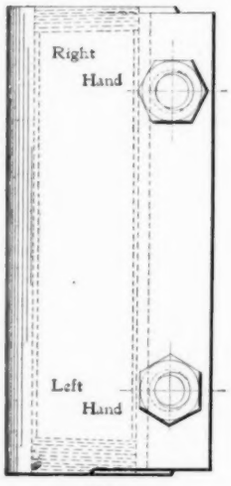

FIG. 3

I have not given all the possible sources of trouble because, for one reason, I do not know them. I have known the exhaust pipe to freeze up and the jacket water to leak into the cylinder, and the exhaust valve not to rise enough because of wear, etc., but I never saw a case that someone could not solve by some such style of reasoning. T. A. B.

Clamp Hubs—Proportions of Links.

Editor American Machinist:

Commenting on the article at page 883 on "Clamp Hubs" the editor has struck

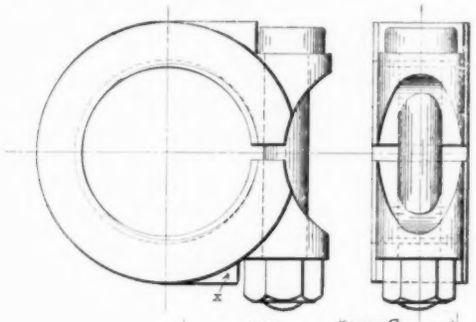

FIG. 2

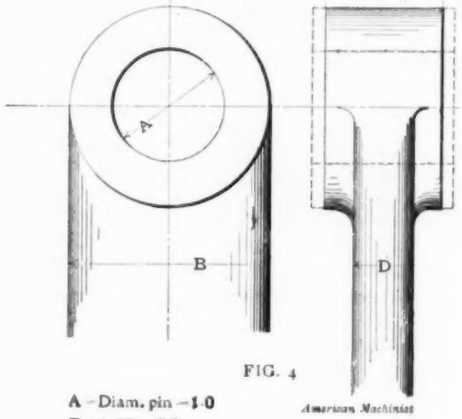

FIG. 4

A = Diam. pin = 1.0
B = 1.75 to 2.0
C = 1.0 to 1.5
D = 0.5 to 0.75

American Machinist

CLAMP HUBS—PROPORTIONS OF LINKS.

the vital point in stating that the clamping screw should be snug up to the shaft. In the writer's estimation, this is *the only way* to make them. Almost all of the trouble with, and condemnation of, this form of fastening is due to neglect of this small but important matter. When the screws are placed some distance away from the shaft the hubs do not clamp tightly, and the efforts to make them do so either break the lugs or strip the threads.

I use clamp hubs wherever possible on both plain and threaded surfaces, and on shafts of considerable size, with uniform success. At first they were made as shown in Fig. 1, but this construction was soon abandoned for the one shown in Fig. 2 and for the following reasons:

Standard screws are made to fit fairly snug when standard drills, counterbores and taps are used to make the holes for them. While collars made as in Fig. 1 will grip well when new, if rightly made, a lit-

tle wear in the collar and shaft, calling for greater compression, will cause the screw to cramp. This is particularly liable to happen when the collar and shaft are of large diameter, and when it occurs makes it nearly impossible to clamp the hub. The force applied is mostly expended in overcoming the friction of the screw and diverted from its legitimate purpose.

Screw-driver heads are not the best things for frequent adjustment where much of a pinch is required. Incidentally the stripping of the thread in the collar renders the collar useless.

In Fig. 2 the collar is cut away on its outside edge, and the bolt is a free fit in hole. Should the thread on clamping bolt or nut strip, a new one effectually repairs the collar. The bolt head is slabbed off on one side to prevent turning. These collars are made of cast iron, steel or bronze. If made of steel, the cost is considerable, but in some cases this is necessary. The small section at x is sometimes removed, when the collars are made of steel, but usually left on, depending on taste and how they are made—whether finished or rough, etc.

The same principle can be applied to turnbuckles or sleeve nuts, as shown in Fig. 3. Either two or three clamp bolts are used, depending on conditions. They grip very powerfully, can be made shorter than the usual form, using two check-nuts for the same amount of adjustment and length of bearing; are extremely rigid and look well [and stay where put, which jamb nuts often do not].

In Fig. 4 is shown the result of an attempt to establish uniformity in the links and connections that are so numerous on many automatic and other machines. The patterns are cheap, containing no carving," simply a flat piece with edges and ends rounded and bosses on ends. When in use they have a uniform and business-like appearance.

The smaller proportions given are usual, and for cast iron increased to larger proportions when it seems necessary. For bronze the sizes may be reduced somewhat. C. L. B.

[By rights, we think, the diameter of the hub B, Fig. 4, should depend on the length C. For long sleeve hubs $B = 2A$ will look and be clumsy, while for very short hubs it will look light.—Ed.]

Trade Matters in Northern Spain and Southern France.

[*From our Special Correspondent.*]

Editor American Machinist:

Martial law was declared in Barcelona again when I reached that city, though I noticed very little of it. Barcelona is by far the most active industrial center of Spain, and the iron industry especially is making steady progress there. The demand for American machinery and tools is steadily increasing, and it is much to be regretted that our manufacturers have paid and are paying so little attention to the Spanish market! Wherever I saw American machinery and tools, I noticed the name of Schuchardt & Schütte, Berlin; Fenwick Frères, Paris, or Charles Churchill & Co., London.

I called upon Mr. Lay, United States Consul General at Barcelona, who introduced me to Mr. T. Alexander, of the firm of T. Alexander y Ca. Up to some time ago Mr. Alexander was partner of the firm of Alexander Hermanos, Barcelona, the largest boilermakers in Spain. T. Alexander y Ca. have just rented an extensive building on one of the principal streets of Barcelona, for the purpose of opening, on a large scale, a warehouse for American machinery. I cannot too much impress upon our manufacturers the fact that *simple* machines will find the best sale. T. Alexander y Ca. are especially interested in gas engines. The financial standing of this firm leaves nothing to be desired. The demand for gas engines in Northern Spain is simply immense. Up to the present time the bulk of the trade has been transacted by Körting Bros., of Körtingsdorf, near Hanover, Germany, and by Crossley, of Manchester. The Gasmotorenfabrik Deutz are also doing a good trade, they having their own office at 40 Carrera de San Jeronimo, Madrid. This firm claims that the cost of fuel for their engines is only from 1 to 2 centimos per horse-power hour. To some extent the Campbell gas engines of Halifax (England) are also sold.

Körting Bros. have their own office in Barcelona, in connection with which they keep a large stock in gas engines, steam and water fittings and machine tools. I called upon the manager of Körting Bros., who was kind enough to take me through their show-rooms, where I was surprised to notice quite a number of American machine tools. When I asked the manager how it was that they carried American machine tools he replied, "Well, we cannot get along without them." He furthermore told me that they get these machine tools through the Hamburg office of Markt & Co., of New York.

T. Alexander y Ca. represent already the Brown Hoisting Machinery Company and are willing to represent some first-class firms for machine tools, fittings, electrical and mining machinery. Gas engine manufacturers should give a clear description of their engines and state horse-power, weight when packed, and price (net) f. o. b. New York, or, still better, c. i. f. Barcelona.

Alberto Ahles y Ca., Paseo Aduana 15-17, Barcelona, are especially interested in agricultural machinery and implements. They are doing a big trade for the Deering Company, of Chicago. They sold this season 110 Deering harvesting machines.

Marseilles is not only the principal port of France, but also a first-class distributing point for Southern France as well as for Algeria and Tunis. Unfortunately, there does not exist a single American business house. The number of good firms actually importing American machinery and tools is small, and no one can tell how capable the other firms open to engagement may be without giving them a trial. As everybody knows who has looked into the matter, we are especially weak in our foreign sales department. The Germans, though not the best friends of the French, are doing quite an extensive trade in France, and you find German traveling salesmen in almost every hotel. Another great drawback in our relations with France is the absence of a commercial treaty. I called upon a number of the leading dealers in machinery and they all agreed that the prospects for American goods are bright. In the south of France the following machines and tools should especially find a ready market, if properly pushed: Machine tools of every description, sawmill and wood-working machinery, excavating and conveying machinery, machines and tools for glass factories, portable cranes, olive oil and wine presses, crucibles, electric and gasoline launches, stone-working and stone-cutting machinery, steam and water fittings, light locomotives for mines and contractors' work, motors, steam pumps, agricultural machinery and implements, and small tools.

Our manufacturers might open correspondence with some of the dealers in machinery in Marseilles, though the best way to get at the trade and to do a successful business would of course be the establishment of a special depot for American machinery under the management of an American. I talked this matter thoroughly over with Mr. Robert P. Skinner, our Consul General at Marseilles, who agrees that such a depot would be a complete success. I know from personal experience that many manufacturers do not believe in such a depot of combined interests, but those gentlemen must not think that they will find in all the principal cities a leading house which they can easily and exclusively interest in their machines, and especially not by simply sending them a catalog printed in English. Manufacturers who are really anxious to do business abroad should at least send an experienced salesman to call upon the principal dealers in their line and to explain the advantages of their makes. This is what German and English manufacturers have done for a number of years and are still doing, and therein lies their success.

HENRY L. GEISSEL.

According to a press despatch, a machinist who was some years ago sentenced to the State Prison of New Jersey for burglary has, during his imprisonment, invented a sewing machine of considerable merit, and has been pardoned to take a position as superintendent of a factory which is to manufacture the machine, a million-dollar company having been organized for the purpose.

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Over-Capitalization not Inconsistent With Good Methods.

Our British contemporary, *The Mechanical Engineer*, in an article on "Trade Trusts and Combines," shows, apparently to its own satisfaction, that such things cannot permanently succeed. It instances a number of British corporations of the kind which have failed and the stocks of which are now at a very low value, and then goes on to give the reasons why such combines have not been successful. Among these it mentions the burden of "over-capitalization," though just how over-capitalization is necessarily burdensome to industrial operations is not made quite clear. If a manufacturing concern is over-capitalized, the results will be shown in small or missing dividends and in low values of shares, but such low dividends or values will not necessarily interfere with the actual operations of carrying on a manufacturing establishment, and it can make its goods as well and as economically and can compete in the market as effectively as if it were not at all over-capitalized.

Our contemporary goes on to say that in the case of some of the combines it mentions dissatisfaction of shareholders with the low dividends led to attempts at economy, which attempts took the form of dispensing with the services of skilled and high-priced experts and the substitution of cheaper men. Now, of course, this is something which, if done by a concern that is over-capitalized, under-capitalized or capitalized at just the right figures, will always result in loss of money. But this is true irrespective of any question of so-called trusts or trade organizations; the fact being that if a combination or trust owning a number of manufacturing establishments is so managed as to devote the same attention by practically the same kind of men to its branches that was given before the combination, there is no reason why it will not succeed as well or better than when the various concerns were operated separately. It is simply a question of methods of conducting a business, and methods may be good or bad, regardless of whether a concern is capitalized for the right amount or whether it is over-capitalized. Methods are sometimes bad because of insufficient working capital to make them good; but too much capital or too much issuing of stock certificates need not affect methods of manufacturing in the least.

Some Limitations of Schools.

A contributor, whose writings often appear in our pages and who happens to be taking a course with one of the correspondence schools, writes as follows:

"C. H. Norton, in 'Wrong Impressions Given by Mechanical Schools' [page 980], hits it just right. I guess he must have seen some of my drawings after they were returned to me."

This suggests a phase of the subject which might not occur to all those who consider it. The fact is, of course, that no school instruction that we know of, whether a correspondence school or any other kind of a school, can give a student exactly what he obtains by practical experience in a shop in which machinery is built for the market. It is almost certain that the draftsman referred to by Mr. Norton had had little, if any, shop experience. The correspondence quoted above, however, has had a long and varied shop experience, and it is quite evident that no erroneous or incomplete instruction given him by a correspondence school or any other sort of instructor would cause him to make the sort of blunders referred to by Mr. Norton. The important fact of this matter is that the vast majority of the students of the correspondence schools are men who have obtained or are obtaining shop experience, which shop experience will supplement their school instruction and prevent their going astray in the manner so clearly set forth by Mr. Norton. The main trouble seems to be that too many people, including the students, expect things of schools which no school can do or ought to try to do. No donkey can be taught to fly; and no book or correspondence instruction can teach a man how to drive a nail.

The First Foundry and the First Casting in America.

It is announced that a monument will be erected at Taunton, Mass., to commemorate the establishment in that vicinity, about 1651, by members of the Leonard family, of the first foundry in America. Descendants of the original Leonards are still in similar lines of enterprise there and the money—about $100,000—has been subscribed by them. Two designs have been made by the sculptor, Chas. H. Niehaus. The date given does not square exactly with statements made concerning a certain iron kettle which was presented by C. J. H. Woodbury to the city of Lynn, Mass., in 1892. In our issue of December 8 of that year we published a picture of this kettle and of a bronze plate made to accompany it, according to which the kettle was the first casting made in America—in 1642.

The French Steel Swindle.

We publish in another column of this issue a report from Fenwick Frères & Co., the well-known machinery agents of Paris, on the French steel matter. It will not be difficult to draw correct conclusions from this report, and anyone who gets caught in this game hereafter will have only himself to blame.

A Brick-Laying Machine.

A representative of the State Department in Canada sent an account of a recently invented machine brought out there which it is said lays brick successfully and

that, worked by two men and a boy, it will lay 400 to 600 bricks per hour; it being suited for all plain work and that it can be put on the market for about $500.

A New York paper has, upon the strength of this report, interviewed a number of bricklayers, builders, etc., all of whom seem very skeptical about the success of the machine. This, however, as anyone experienced in such matters knows, has little bearing upon the case. The average bricklayer or builder is not an inventor of machines and naturally he can have no conception of how a machine could possibly be made to lay brick. Naturally, then, of course, he doubts the possibilty of such a machine, and if anyone states that such a machine has been invented he will almost certainly believe that it is a mistake and that no such machine can be made to work. It is notorious that the men who are engaged in a given occupation are usually the last to be convinced that a machine can be invented which will successfully do their work, or any part of it. The conception of the machine and the belief that it will do the work must nearly always come from outside parties who are unhampered by the traditions of the occupation to which the machine applies. Machinists, themselves, are perhaps the only exceptions to this general law, they being more familiar with machinery and better prepared to accept the fact that it can be made to do a great many things which at first sight seem impossible.

An English Blunder.

Traction and Transmission, of London, makes a ludicrous blunder, if *The Mechanical Engineer*, of Manchester, is to be trusted in making an abstract from its contemporary. In an article on "New York's Tramways," the service of which it tells us is "simply atrocious," it gives the amounts paid as damages for personal injuries in accidents, including, by the way, the tramways of Massachusetts in those of New York! In its list of such damages paid by the different companies it gives 2,500,000 pounds sterling as the amount paid by the New York elevated railroads to date, and it follows these figures by the lurid statement that "the tramways of New York are like Juggernaut cars, not only squeezing the people's pockets but crushing the life out of many of them."

We have no defense for the management of our elevated or surface railroads in their disregard of the comfort of their patrons or for the, until recently, backward policy of the former in adopting modern improvements, for which it is now making amends, but it is the simple truth that, judged by results, there is, as regards safety of passengers, no better system of transit on earth than that afforded by our elevated railroads. The figures given as damages paid for personal injuries are, in fact, the amount paid to *abutting real estate owners* for depreciation of their property from the noise and other features of railroad traffic! Whether the amounts given for the surface roads have the same origin we do not know. As a piece of misinformation our contemporary's statement needs no comment, but it does need correction in the source where it appeared.

The French Steel Swindle.

Editor American Machinist:

We would think advisable for you to call the attention of your readers to the following:

A number of American tool manufacturers that we are representing reported us lately that they had been visited by representatives of French tool steel manufacturers, handing very pretty and attractive visiting cards and soliciting orders for tool steel giving wonderful results, but they never received the steel ordered or the quality that they received was very common and altogether different from the samples that they had been shown. Therefore, these friends wanted to know if we knew anything about the French steel manufacturers referred to. Upon investigation, we found that two of the firms whose addresses were given in this city had simply very small offices, where nobody could give intelligently any information in regard to this surprising steel or tell us where this steel was manufactured and name us reliable references. Another, whose representative claimed to be personally acquainted with us, was found to have never existed in the French city named.

We leave to the interested partics among your readers to draw themselves the conclusion they will like from the above report. We remain, gentlemen,

Yours truly,

FENWICK FRERES & CO.

Paris, July 5. F. MANDON.

It has been decided in the courts of Wyoming that the Union Pacific Railroad Company has violated the statutes by bringing into Wyoming an armed body of guards to protect its property.

The seventeenth annual outing of the employees of the Jeffries Manufacturing Company, Columbus, Ohio, was held on the 12th inst., at Idlewilde Park, and judging from the program, copy of which is before us, a general good time was had, as usual.

It is announced in the press that a national conference of employers and employees will be held at Minneapolis, September 22 to 26, although no information is given as to the persons issuing the call or under whose auspices the conference will be held.

When writing for publication, don't cover every particle of space on your paper. Leave a margin and some space at the top of each page, twice as much at the top of the first one, and space the lines far apart, so that words can be written between them if need be.

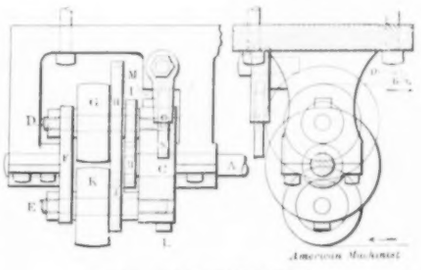
Manchester is the site selected for the next "World's Fair." It is proposed to open in May, 1903. As planned, the exhibits will consist of the world's work up to date in the way of machinery, textiles, scientific research, photography, electricity, education, agriculture, aerial navigation, and the fine arts. The exhibition will be distinctly international in character. The undertaking is in the hands of men experienced in exhibition matters, and plans of the Palaces of industry and of the liberal and fine arts are already out of the architects' hands.—*The Engineer.*

It seems that there are officials in Russia who believe that trusts have assumed sufficient importance to entitle them to special consideration by an international conference, and the nations have been invited to take part in such a conference. This, however, does not include our own country, in which there is probably much more information about trusts than can be found elsewhere. They have some exaggerated ideas abroad, however, and the Russians may think that to ask us to participate in such a conference would resemble the installing of a culprit as judge to try his own case.

Some New Things.

REVERSING MECHANISM.

The cut shows a reversing device patented by Chas. W. James, 4140 Parrish street, Philadelphia, Pa. The device may be used on a countershaft, as shown, or it may be attached to any machine spindle or shaft which has to be reversed. In the



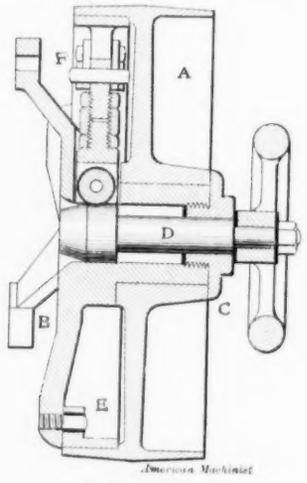
REVERSING MECHANISM.

illustration, *A* is the shaft to be driven and *B* is a gear which is keyed fast on the end of *A*. Mounted loosely on *A* is a disk *C*. This disk is connected by two studs, *D* and *E*, with a piece *F*, which has a long hub running in the outer bearing. The two parts *C* and *F* are tied firmly by the studs and a frame is thus formed for carrying the pulleys and gears which drive the shaft. The pulley *G*, which runs on stud *D*, has fast upon its hub two gears *H* and *I*. Gear *H* meshes with a gear *J*, which is fastened on the hub of pulley *K*

running on stud *E*, and gear *I* meshes with gear *B* keyed to shaft *A*. The disk *C* carries two stops *L* and *M*. An arm *N*, which is cushioned at *O*, is hung in front of the disk and may be swung in line with either stop. The mechanism is shown reversing, and it will be noticed that the driving belt from the main line is in contact with both pulleys. With the belt running in the direction indicated by the arrows, the whole frame, with its pulleys and gears, will be swung about the shaft *A* until the stop *L* strikes the arm *N*. In this position the belt will clear the pulley *G* and drive pulley *K*—gear *J* driving shaft *A* through gears *H*, *I* and *B*. When the arm *N* is moved to the left the disk *C* is released; the frame makes a half turn about the shaft, and is brought to rest by the stop *M*. The pulley *G* is now driven —the belt clearing pulley *K*—and the shaft being driven direct from gear *I* will rotate in a direction opposite that in which it rotated when driven from gear *J*. With the gears proportioned as shown, the shaft *A* runs faster when the driving belt is on pulley *G* than when it is on pulley *K*. The gears may, of course, be proportioned to drive the shaft at the same speed in either direction. This mechanism is always ready to reverse when the arm *N* is moved to clear the stops. The arm may be moved by hand by means of a shipper rod or automatically by some reciprocating member of the machine that is being driven.

A NEW FRICTION CLUTCH.

The cut shows a pulley, with a friction driving clutch, for gas, gasoline or oil engine. The pulley *A* is a running fit on the hub of a carrier *B* that is bolted fast to

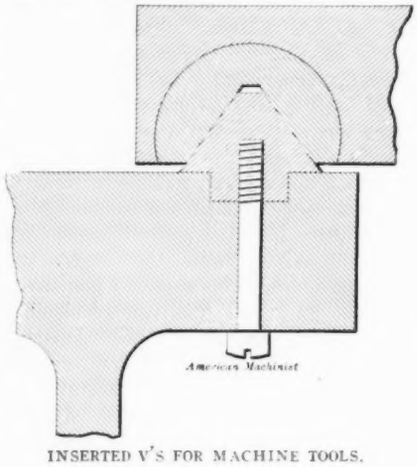


FRICTION CLUTCH.

the flywheel of the engine. A cap *C* at the front of the carrier hub holds the pulley in place. This cap is bored out to form a guide for the spindle or plunger *D*, which has a cone at the inner end fitting the bore of the hub. The split friction ring or shoe *E*—which is mounted on the carrier in such a manner that it has a certain amount of freedom—is opened against the friction surface in the pulley rim by means of a toggle *F*. This toggle has an adjustable rod which carries at its lower end a roll resting on the cone on the plunger. When this plunger is pushed in, by means of the hand-wheel, the cone moves the adjustable rod, and the ring being opened by the toggle grips the pulley. To release the pulley the plunger is drawn out until the cone strikes the stop. This clutch is made by the Casner Pulley Company, Aurora, Ind.

INSERTED V'S FOR MACHINE TOOLS.

J. J. Osgood, 131 Erie County Bank Building, Buffalo, N. Y., has recently patented an improvement in lathes, planers and other machines constructed with sliding surfaces. This improvement is in the guides or V's, which are made of steel and inserted in the bed and sliding members of the machine, as shown in the accompanying illustration. These V's are hardened to prevent wear, and after being put in place are ground true.



INSERTED V'S FOR MACHINE TOOLS.

Technical Publications.

"Textile World Official Directory of the Textile Industries for 1902," including the Yarn Trade Index; published by Guild & Lord, Boston, Mass. Pp. 463, 6x9 inches. Price of office edition, $2.50. Traveler's edition (in thin paper and soft covers), $2.00.

This new annual edition of the textile directory, besides being brought up to date in its other features, is augmented by a directory of Canadian textile mills with a textile map of Canada. Our own use of the book in past years has given us a very favorable opinion of it as a directory in its line. There seems to be little if anything lacking in point of comprehensiveness.

"The Balancing of Engines." By W. E. Dalby. 283 5½x8½-inch pages with 173 illustrations. Longmans, Green & Co., New York. Edward Arnold, London. Price, $3.75.

With the increasing size and speed of steamships, and especially of torpedo boats, the vibration due to unbalanced engines has become a subject of large importance and of considerable complexity. It has received very serious consideration in England, both analytical and experimental, at the hands of Otto Schlick, A. F. Yarrow and others, most of the results of these investigations having been contributed as papers to the Transactions of the Institution of Naval Architects. The present volume is a systematic treatise based largely on these various papers, and is, we believe, the only book which treats the subject with anything approaching completeness. To those having to deal with its problems it will be found extremely valuable and strictly practical in the best sense. The solutions are by graphical and mathematical methods combined. While the balancing of engines of the marine type occupies the major portion of the book, the balancing of locomotives is also considered. The mechanical execution is of the superior quality which characterizes many English technical books and which we could wish some of our American publishers would emulate, or at least measurably approach.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(11) Igno Ramus, Moscow, Idaho, says: It is claimed by nearly all old threshermen that in setting the machines on ground where the engine has to be placed either above or below the separator the engine will pull the load easier and with less consumption of fuel if it is placed below the separator. Others claim it is the opposite way, but nearly all agree that it makes a "pile o' difference." I have had ten years' experience in handling engines in the field and am inclined to regard the whole as a thresherman's superstition. Have argued the matter innumerable times, but they shake their dusty heads as much as to say, "You may *savvy* your engine all right, but you are off there." Am I right or are the other fellows right? A.—We think you are right, and, so far as we can see, it will make no difference whether the engine is below, above or on the level with the separator. There may, however, be some peculiar conditions in threshing grain that do not enter into the development and consumption of power in other service; but certainly no engineer would think of providing a different size engine to do the same work if the driven pulley were at a lower level than he would provide were the driven pulley above the engine pulley, or if the two were at the same level. It is simply a matter of foot-pounds of work to be done per minute.

One of the recent patents is for a homoglobinometer. It is for determining the amount of homoglobin in the blood. There is no suggestion as to whether homoglobinosity is a desirable or an undesirable condition or whether homoglobinossification would be fatal or not.

The Mathematician in Love.

It is not, we think, generally known that Professor Rankine—he of thermodynamics and the calculus—ever dipped into verse. A friend sends us the following pleasantry from his pen:

A mathematician fell madly in love
With a lady, young, handsome and charming;
By angles and ratios harmonic he strove
Her curves and proportions all faultless to prove
As he scrawled hieroglyphics alarming.

He measured with care, from the ends of a base,
The arcs which her features subtended;
Then he framed transcendental equations to trace
The flowing outlines of her figure and face,
And thought the result very splendid.

He studied (since music has charms for the fair)
The theory of fiddles and whistles,
Then composed, by acoustic equations, an air
Which, when 'twas performed, made the lady's long hair
Stand on end, like a porcupine's bristles.

The lady loved dancing; he therefore applied
To the polka and waltz an equation;
But when to rotate on his axis he tried,
His center of gravity swayed to one side,
And he fell, by the earth's gravitation.

No doubts of the facts of his suit made him pause,
For he proved, to his own satisfaction,
That the fair one returned his affections; because,
"As everyone knows, by mechanical laws,
Re-action is equal to action."

"Let x denote beauty, y manners well bred,
z fortune (this last is essential);
Let L stand for love," our philosopher said,
"Then L is a function of x, y and z,
Of the kind which is known as potential.

"Now integrate L with respect to $d\,t$
(t standing for time and persuasion);
Then, between proper limits, 'tis easy to see
The definite integral Marriage must be—
(A very concise demonstration)."

Said he, "If the wandering course of the moon
By algebra can be predicted,
The female affections must yield to it soon"—
But the lady ran off with a dashing dragoon,
And left him amazed and afflicted.

Cutlery by a New Process.

Joseph Misko, mechanical engineer, of 253 Broadway, New York, is interested in the establishment of a cutlery works which may be located in Pittsburgh and which will manufacture cutlery by what appears to be an entirely new and novel process. This process, in brief, consists in first grinding and polishing the rod from which the forgings are to be made. This rod is then passed into a chamber from which the air is exhausted, and an electric current is then passed through the rod, heating it to the forging temperature. Within the chamber are dies op rated by hydraulic pressure which forge the rod closely to size; in fact, it is claimed that the forging can be brought down to the finished size so as to require no grinding, and as no air is in contact with it while it is heated, of course no oxidation can take place and the forgings are as bright as was the rod before being heated. The hardening is also done in a chamber from which the atmosphere is excluded, and cooling is by means of dies made to fit the pieces and hollow, with a circulation of brine within, so that the heat is conducted from the forgings through these dies instead of by direct contact with the brine. The forgings are at this point still connected and are tempered also by an electric current in the atmosphere, after which they are broken apart, the ends finished by grinding upon grinding wheels which are of iron, made hollow and arranged for the circulation of refrigerated brine within to prevent the generation of heat and possible drawing of temper. The plan is to make use of machinery throughout and to dispense almost entirely with hand labor. We do not know to what extent this process has been tried, but it has apparently attractive features.

Commercial Review.

NEW YORK, Monday, July 21.

VARIOUS TRADE NOTES.

The unwillingness of the soft coal miners at the Indianapolis convention to go out on strike in sympathy with their anthracite brethren, and the possibility that the anthracite mines will be reopened at an early date should go far to relieve the tension on business incident to the labor difficulties. Machine tools have had their own similar dispensation in the blowing by of the Worcester strike, although it can hardly be said that this, while it lasted, tended to retard trade, except so far as it inconvenienced the operations of a few builders.

The tone of the machine-tool market, locally, is most healthful—"strong" it was characterized by one well-known seller, and he repeated the word emphatically. He meant that there was a buoyant inquiry and an atmosphere favorable to the maintenance of good prices. It is worthy of note that not only his, but another concern in town, both doing a miscellaneous and representative business, has noticed a distinct improvement in demand as compared with what it was not long ago. While not all whom we have talked with report precisely the same relative conditions, the consensus of opinion received evidences a splendid trade for this, the naturally dull season of the year.

The advance in prices of machine tools which has been instanced in sporadic cases for several months past, which received important assistance when the lathe builders met in New York, and which has been spreading out since that time, was still further generalized at Niagara Falls, June 15. About twenty manufacturers of such machine tools as drill presses, planers and shapers held a meeting on that day and decided to recommend an advance of 5 to 10 per cent. in prices. Many of the concerns represented joined the National Machine Tool Builders' Association. Some of the firms at the meeting, we have heard, have already advanced prices; so probably the action in their case will amount to little or nothing more than a confirmation.

Quite a number of orders of recent date have come to notice. The International Steam Pump Company is buying some heavy machinery which is supposed to be intended for installation in its present plants, to meet current exigencies of business. Some of this machinery has lately been ordered, though relatively a small valuation. But in its new shops building at Harrison, N. J., the International Steam Pump Company intends to install sixteen cranes to be made by the Niles-Bement-Pond Company. These cranes will be of 30, 20, 8 and 5-ton sizes. We think that the number includes some of other than the traveling type. The dimensions of the cranes are not in all respects finally settled, being contingent upon the ultimate plans for the new shops. The New York Central Railroad has ordered some $25,000 worth of tools from the Niles-Bement-Pond Company for the Oak Grove (Pa.) shops.

Among other buying that has recently been done is the awarding of contracts for some fifty tools for the Newport marine shops of the New York, New Haven & Hartford Railroad. We long ago mentioned the pendency of this contract. The General Electric Company has been purchasing some $25,000 or $30,000 worth of tools. Both electrical and sewing-machine manufacturers are alluded to as characteristic buyers at present.

A call at the works of the Binsse Machine Company at Newark, N. J., found that concern enjoying a steady and most excellent business. Half a dozen of the company's specialty—horizontal boring mills—have recently been sold to the Pennsylvania Railroad for installation in its various shops. At the beginning of June prices were advanced about 5 per cent., this not more than covering the rise in cost of materials, etc. Not only castings, it is pointed out, but all sorts of details used in machine tools, such as cap screws, have gone up in price, thus affecting profits on the completed machine. The general condition of machine shops in Newark is understood to be one of activity.

In reply to an inquiry about the state of business, the Brown & Sharpe Manufacturing Company has written us as follows: "We feel that business is holding up remarkably well, the sales continuing along into the summer more than is usual. An encouraging feature of business, and which tends to show, it seems to us, a substantial condition, is that most of the tools that we are selling are to old-established concerns, who are enlarging their plants or improving their equipment. At the present time we have 2,100 men upon our payroll, and the future seems bright for a continuation of the present business conditions."

The Brown & Sharpe Manufacturing Company has made its customary summer announcement that its works will be closed from August 2 to August 16, inclusive, for the annual vacation and repairs. Meanwhile the office will be kept open and orders for machine tools, machinists' tools and measuring tools, listed in the catalog, will receive attention as usual.

It is reported that the British firm of

Buck & Hickman, of Whitechapel, London, E., which represents the interests of several American machine-tool manufacturers on the other side, has been incorporated under the British Joint Stock Company Act with a capital of $700,000.

The Moline Tool Company, Moline, Ill., has recently purchased from the Root & Van DerVoort Engineering Company, of East Moline, Ill., the patterns, stock on hand, good will, etc., of the R. & V. speed lathes which the latter concern has manufactured up to this time. The Moline Tool Company will push this along with its line of gang drills and special machinery.

The Lunkenheimer Company, Cincinnati, Ohio, has recently purchased a large number of Westinghouse induction motors for the equipment of its new works.

Jones & Laughlins, Ltd., of Pittsburgh, Pa., are continually making additions to their electrical equipment and have just recently ordered from the Westinghouse Electric & Manufacturing Company one 800-kilowatt direct-connected generator, two 150-kilowatt motor-driven two-phase alternators, and two 125-light motor-driven arc generators.

The Philadelphia Pneumatic Tool Company, Philadelphia, Pa., informs us that it has concluded arrangements for representation in South Africa, with headquarters at Johannesburg. This agency will be in charge of General Samuel Pearson, late of the Boer forces. General Pearson has been in the United States for some months in the interests of his government, in the attempt to have the mule shipments from Port Chalmette stopped. Now that peace has been declared he will return to his former business in machinery lines and will handle the accounts of the Philadelphia Pneumatic Tool Company and others. Before coming to America, General Pearson saw much active service in the field, for a time in charge of railway traffic.

Earnings of the American Shipbuilding Company for the year ending June 30 are placed at $1,520,000, after allowing for dividends and charging off a liberal amount for depreciation. The net as above is equal to about 20 per cent. on the common stock, and the total surplus of the company is estimated at $3,262,000.

The American Bicycle Company is reported to be doing a good business this year both in bicycles and automobiles. While the company's fiscal year does not end until August 1, the output of bicycles thus far this year, it is said, is largely in excess of that of last year.

TRADE RELATIONS OF SPAIN AND THE UNITED STATES.

Emillio de Ojedo, the new Spanish Minister to the United States, has spoken on the bright prospects of commerce between this country and Spain in an interview, of which the following is an abridged version:

"The feeling in Spain for the United States is one of great cordiality. The recent war was only a parenthesis in our relations, and the cloud it caused will soon be spent. Even while it raged, the feeling in Spain against America could hardly be termed bitter. It was not a national war in the accepted term; there was not the intense national feeling that would have developed had the contest been with one of Spain's hereditary foes, or if the invasion of our country by the American forces had taken place. The war was in fact made necessary by dignity and brought to an issue conditions we had long regarded as inevitable. Therefore our people were, in a measure, prepared for the sacrifices we had to make and for the disasters that came.

"Spanish sentiment is very strongly in favor of the proposed Spanish-American treaty of reciprocity. Having lost our colonies, Spaniards realize the importance of increasing commercial relations in order to adjust affairs to new conditions. But what is most needed as a preparation for increased commercial intercourse is a better understanding and more general communication between the Americans and Spaniards.

"Marquis Comillas, whom some point to as the Spanish J. Pierpont Morgan, has, in my opinion, hit upon a plan to create this better understanding. The Marquis is president of the Translatlantic Steamship Company, and his idea is to establish a syndicate to include Spanish bankers, railroad companies, hotel keepers, and others to encourage Americans to visit Spain and to learn just what there is there. So strongly is this idea taking root that new hotels are projected in several of our large cities.

"The spirit of consolidation is developing in Spain along very broad lines. We have made great progress of late in shipbuilding and have also given more attention to sugar growing and planting. Having lost her colonies, Spain realizes the necessity of increasing her foreign trade. The matter has been taken up by the government and the latter has opened an exposition where articles of Spanish production that ought to find a foreign market are on exhibition with the ruling prices attached to them. Connected with it is a transportation bureau intended to show methods of packing and shipment.

"A strong illustration of the commercial progress made between my country and this is the recent establishment of the Larrinaga Line of direct service between New York and ports of the northern part of Spain.

CHICAGO MACHINERY MARKET.

Several circumstances have combined to make the local trade for electrical machinery in Chicago less active during the past few weeks than has been the tributary country buying. Electrical machinery contractors say the conflict between the wiremen and the gas fitters as to which trade shall put in the wire conduits in buildings is seriously impeding much of the city work. Most other cities have adjusted the matter, some in favor of the wiremen and some in favor of the gas fitters, but in Chicago it remains an open labor issue. Then, too, the freight handlers and teamsters' strikes of recent date occasioned the withdrawal of much work that was in sight until full harmony in the labor world was restored.

But orders from out of town, not affected by these conditions, have been very satisfactory. And, locally speaking, one of the significant omens regarding the immediate future is that a number of propositions which were figured on some two years ago and then pigeon-holed have lately come out from their retirement and new bids have been asked thereon. Perhaps without exception the Western representatives of electrical machinery builders are disposed to regard the future, the immediate future, as most promising of orders. And when the shop end of the trade is considered, it is found to be excellent. Some representatives say they cannot make deliveries desired and are losing business right along for that reason. They usually admit, however, that their competitors can do better.

There is in this city quite a spirited competition between the company which supplies power to factories and buildings from the current in the street and the companies which supply independent plants for generating current on the premises. The former has taken some large structures and has put in connections at very low cost to secure the business. One of the interesting contracts which it is believed will soon be placed is the electrical requirements for the new and imposing Lake Shore and Rock Island Station in process of construction on Van Buren street. Bids of all kinds have been asked for and there is on the outside much interest as to the result.

The Akron Electrical Manufacturing Company has lately effected a number of desirable transactions in this city. It has been especially fortunate with the elevator trade.

The Crocker-Wheeler Company has sold to the McCormick Harvesting Machine Company one 300-kilowatt engine-type generator, two 225-kilowatt belted generators and one 100 horse-power belted motor. It has also sold to the Minneapolis Steel & Machinery Company, Minneapolis, Minn., one 145-kilowatt engine-type generator.

Quotations.

NEW YORK, Monday, July 21.

The pig-iron market is very irregular. While one leading firm advised making no change in nominal quotations from last week, another prominent seller named as a price on Pennsylvania irons, this year's delivery, $26.65 for No. 1 X and $25.65 for No. 2 X. He said that his Pennsylvania companies refuse to quote for 1903. He

offers no Southern iron for 1903, but for this year names:

No. 1 foundry, or soft....$22 25 @$22 75
No. 2 foundry, or soft.... 21 25 @ 21 75
No. 3 foundry..... 20 75 @ 21 75

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93c. upward in carload lots. Smaller quantities from store, 2.15c. upward.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel — Base sizes — From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 12⅛ @ 12½c.; electrolytic and casting, 12 @ 12.20c.

Pig Tin—In 5- and 10-ton lots, f. o. b. New York, 29c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—5¼ @ 5⅜c., New York.

Antimony — Cookson's, 10 @ 10½c.; Hallett's, and U. S., 8 @ 8¼c.

Lard Oil—Prime City, 84 @ 90c., according to brand and quantity ranging from one barrel up to large lots.

New Catalogs.

Lombard & Co., Boston, Mass. Grindstones. 6x8, pp. 16, paper.

James Beggs & Co., 9 Dey street, New York. Engines and boilers. Folder.

McCrosky & Huber, Cincinnati, Ohio. Reamers. 3½x6¼, pp. 10, paper.

Crocker-Wheeler Company, Ampere, N. J. Motor-driven tools. Bulletin No. 24. 7½x10, pp. 25, burlap.

American Air Compressor Works, 26 Cortlandt street, New York. Air compressors. 5½x6¾, pp. 24, paper.

Boston Testing Laboratories, Boston, Mass. Apparatus for the Metallographic Laboratory. 6¼x9¾, pp. 45, paper.

Putnam & Co., 150 Nassau street, New York. Overhead tracking, scales, conveyors, etc. 6x9, pp. 23, paper.

The Garvin Machine Company, Spring and Varick streets, New York. Second-hand machine tools. List No. 25.

Garvin Machine Company, Spring and Varick streets, New York. Milling machine attachments. 6x9, pp. 23, paper.

General Construction Company, Seattle, Wash. Bewsher sand pumps and gold dredging machinery. 7x10, pp. 8, paper.

Dobbie Foundry & Machine Company, Niagara Falls, N. Y. Contractors' and quarrymen's machinery. 6x9, pp. 206, paper.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. "Electric Motor-Vehicle Equipments." Circular No 1059.

Wiley & Russell Manufacturing Company, Greenfield, Mass. General catalog of screw-cutting machinery and tools. 3½x5½, pp. 221, paper.

The Automobile & Cycle Parts Company, Cleveland, Ohio. Brass and bell metal balls, tool steel and bessemer balls, high duty tool steel balls. Three pamphlets, 3½x6, paper.

Massachusetts Institute of Technology, Boston, Mass. Thirty-seventh annual catalog. 6x9, pp. 429, paper. Annual report of the president and treasurer, Dec., 1901. 6x9, pp. 82, paper.

Bickford Drill & Tool Company, Cincinnati, Ohio. "Fifty-six Points of Vantage Embodied in the New Bickford Drill." 1902 edition, 4x6, pp. 46, paper. "Full Universal Radial Drill," circular.

The Brown & Sharpe Manufacturing Company, Providence, R. I. Universal milling machines, distinctive features, 6x9, pp. 21, paper. Automatic gear cutting machines, 6x9, pp. 24, paper.

L. S. Heald & Son, Barre, Mass. American grinding attachment, pp. 15; American center grinder, pp. 15; American sash trimmer and Heald dado machine, pp. 20. Size each, 5¼x8, paper. American twist drill grinder, 3½x6, paper.

Whitney Manufacturing Company, Hartford, Conn. Chain, milling machines, vertical automatic deep hole drilling machine, tool grinder, wheel truing device, drill chucks and collets, Woodruff system of keying. 3½x6, circulars.

Chapman Valve Manufacturing Company, Indian Orchard, Mass. Valves. This catalog is gotten up as a souvenir of the May meeting of the A. S. M. E. at Boston, and is particularly artistic and attractive in appearance. 5½x9, pp. 30, paper.

Hyatt Roller Bearing Company, Harrison, N. J. "Hyatt Flexible Roller Bushings as Applied to Loose Pulleys"—Bulletin No. 24, 7x8½, pp. 14, paper. "Comparative Tests Hyatt Flexible Roller Versus Solid Steel Rollers"—7x8⅜, pp. 12, paper.

The Consolidated Engine Stop Company, 100 Broadway, New York, has published an especially attractive catalog of the Monarch automatic engine stop system, with a description of the "Monarch System" of automatic safety devices as applied to steam engines and electric motors. Size 8x10, paper, 32 pages, printed in two colors throughout.

The Link-Belt Engineering Company, Philadelphia, Pa., sends us its 1902 catalog. It is bound in cloth and has 320 pages of profusely illustrated matter covering coal-handling machinery, conveying machinery for all purposes, industrial railways, rope drives, chain, link-belting, sprocket wheels, etc. The information and data given are so complete that the catalog could really be called a text book on elevating and conveying apparatus and the transmission of power. It is 6x9 in size, and would make a valuable addition to any engineering or mechanical library.

New Corporations.

Argonaut Iron Works. Incorporators: E. B. Demarest, A. E. Perkins and Chas. D. Smyth, of Angel's Camp, Cal.

Excelsior Slugger & Tacker Machine Company, of New York; object, manufacturing machinery for making boots, shoes, etc.; capital, $500,000.

Standard Machine Co.; principal office, Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing machinery; capital, $100,000.

The California Drilling & Fish Tool Company has been incorporated by Edward Double, W. F. Dinger, *et al.*, with principal place of business Los Angeles, Cal.

Quincy Electric Drill Co.; capital, $500,000; principal office, 1 Exchange place, Jersey City, N. J. Incorporators: George F. Bradstreet, of Boston; Richard M. Farries, Jersey City, and Herbert L. Keyes, Hackensack, N. J.

American Valve & Meter Co., of Cincinnati, O.; capital stock, $30,000. Incorporators: N. P. Fermer, Jr.; William Porteous, Frank Forters, D. S. Warfilt and Charles Prior, of Cincinnati.

The Williams Pump Co., of Indianapolis, Ind.; capital stock, $10,000. Pumps and other machinery will be manufactured. Andrew C. Franke, Lee H. Williams and Frederick Zwicker are directors.

Electric Metal Separating Co.; principal office, 46 Haledon avenue, Paterson, N. J.; object, refining scrap metals, etc.; capital, $150,000. Incorporators: Samuel Boehm, Wm. Jacobus and John Unger.

American Railway Castings Co.; principal office, 243 Washington street, Jersey City, N. J.; object, manufacturing railway castings, etc.; capital, $500,000. Incorporators: Chas. N. King, Le Grand Bouker and W. M. Greene.

Raritan Structural Steel Co.; principal office, 227 Townsend street, New Brunswick, N. J.; object, manufacturing structural steel; capital, $300,000. Incorporators: Chas. F. Terney, Winfield S. Thorp and Julian N. Pinkney.

Hutchinson Stair Elevator Co., of New York; object, to build, construct, equip and erect stair elevators. Incorporators: Chas. W. Mackey, New York; G. A. Conger, Bellevue, Cal.; James Wirdin, Dover, Del.; capital, $1,000,000.

International Foundry Co.; capital, $5,000,000; object, manufacturing iron brake shoes under the patent of Charles Svekely and manufacturing iron castings. Incorporators: Claude L. Stillman, of Newark, N. J.; Nathan Divader, Nathan Boehm, Charles Svekely, New York; Frederick Parsons, Tarrytown, N. Y.

Manufacturers.

The foundation is completed for Spargo's new wire mill in East Rome, N. Y.

Benjamin Lamb is building a machine shop at Plainville, Conn., or in that vicinity.

The Rock Island (Ill.) Plow Company will erect an eight-story building, 80x130 feet.

Congressman A. Gaston, of Meadville, Pa., will erect a ship timber mill near Niles, O.

The shingle mill of the Kellogg Mill Company, Ballard, Wash., has been destroyed by fire.

A new mill is to be built for the Columbian Manufacturing Company, textiles, Greenville, N. H.

Plans have been drawn up for a machine shop at Venice, Ill., for the Chicago & Alton Railroad.

It is rumored that a foundry may be built at Endicott, N. Y., by a Mr. Markham, of Harpursville.

William F. Taubel, of Riverside, N. J., has purchased at Shamokin, Pa., a site for a hosiery plant.

The City Council, Washington, Ia., has passed an ordinance for building a municipal lighting plant.

It is reported from Kelso, Wash., that Joe Hill will put in a sawmill somewhere on the Columbia River.

A machine shop, 153x112 feet, is to be built for the Standard Roller Bearing Company, Philadelphia, Pa.

The McClary Manufacturing Company, Ltd., stoves, stamped ware, etc., London, Ont., will erect an addition.

An addition to the plant of the McCullough-Dalzell Crucible Company, Pittsburgh, Pa., is being planned for.

E. B. & A. C. Whiting, of Burlington, Vt., manufacturers of brush fiber goods, are building a new factory.

The Acme Box Company, Wheeling, W. Va., will shortly construct a new plant to replace one destroyed by fire.

The management of the Bryigon Foundry Company, Reading, Pa., steel castings, contemplates enlarging the plant.

A new building is to be erected for the

Branson Machine Company, manufacturer of knitting machines, Philadelphia.

George F. Williams, of Watertown, N. Y., is erecting a plant in Dexter, N. Y., for the manufacture of gasoline engines.

It is stated from Sumner, Wash., that the White River Lumber Company will rebuild its mill recently destroyed by fire.

The Lovell Manufacturing Company, wringers and electrical goods, Erie, Pa., has taken out a permit for a factory building.

Plans have been made for the erection of the plant of the Colonial Foundry & Machinery Company, South Norwalk, Conn.

The Pneumatic Wheel Company, Freehold, N. J., will enlarge its works by the addition of a building, 72x30 feet, two stories.

J. F. Boapple, pearl button manufacturer, Davenport, Ia., has purchased land on which it is intended to erect a new factory.

A three-story brick addition will be built to the plant of Schofield, Mason & Co., manufacturers of carpets, Philadelphia, Pa.

Work is progressing on the machine shop of the Empire Shipbuilding Company, at Genesee and Rock streets, Buffalo, N. Y.

The Patchogue (N. Y.) Manufacturing Company has awarded a contract to build two more buildings to enlarge its lace mills.

I. S. & I. N. Minor, of Glendale, Cal., announce that they will rebuild the Warren Creek shingle mill recently destroyed by fire.

It is expected that work on a large additional plant of the Brookside Cotton Mills, Knoxville, Tenn., will commence September 1.

A building occupied by the Fred. Barker Company, iron founder, Paterson, N. J., as a machine and molding shop has been gutted by fire.

The Towle Manufacturing Company, silversmith, Newburyport, Mass., is building an addition and will put in a new set of heavy boilers.

The Globe Paper Mill Company will erect a wall-paper plant on the west side of Halsted street, south of Forty-eighth court, Chicago, Ill.

The Indianapolis (Ind.) Abattoir Company will increase its capital stock from $200,000 to $500,000 and build an addition, installing machinery.

J. C. Thomas, contractor, of Clifton, Ariz., will examine the lumber supply of Graham mountains, with a view of erecting a sawmill there.

An addition, 40x90 feet, is about to be built to a machine shop of the Taunton-New Bedford Copper Company, Taunton and New Bedford, Mass.

The Bowdoin Paper Manufacturing Company, Topsham, Me., is planning for a mill to be erected this year, the product to be ground wood fiber.

The St. Louis (Mo.) Brass Manufacturing Company has leased property which will be converted into a gas and electric fixture manufacturing plant.

Ground has been broken for a plant at Buffalo, N. Y., to be known as the Buffalo Pottery. It is affiliated with the Larkin Soap Company, of that place.

The Malleable Iron Fittings Company, of Branford, Conn., is to erect a new building this summer and fall, 200x118 feet, to be used as an annealing shop.

It is reported from Roseberg, Ore., that W. P. Johnson proposes to construct a sawmill on Myrtle Creek. N. Selig has the matter of securing a site in charge.

Plans are being perfected by the Glasgow Iron Company, of Philadelphia, for the erection of two open hearth furnaces at that company's plant, in Pottstown, Pa.

The Diamond Drill & Machine Company, of Birdsboro, Pa., is making iron castings now, practically losing but three weeks from the loss of its foundry by its recent fire.

E. F. Pennebaker, of the Madison Power Company, says he will construct an electric plant at Virginia City, Mont., as soon as 1,000 horse-power is contracted for.

John A. Crilley, of Hartford, Conn., proposes to erect a clock factory, 80x170 feet, three stories, at St. Albans, Vt. It is thought 200 men will be employed at the start.

The Pacific Light & Power Company has been granted a franchise to erect a lighting plant in Hollywood, near Los Angeles, Cal. It must be completed within six months.

Fire has destroyed the foundry building of Joseph Thompson & Co., in the northeastern section of Philadelphia, Pa. Valuable patterns and machinery were rendered useless.

Uneva Lake, 28 miles northeast of Leadville, Colo., has been bought by Frank Howbert, C. D. Ford and E. Chapin Gard, of Denver. It is said that plans are being made for an electric power plant.

Geo. H. Barnes, promoter of the Western Fence Company, Davenport, Ia., has received plans for a building, 400x100 feet, to include engine-room, loom-room, etc. The looms are now being built.

The Sheffield Car Company, Three Rivers, Mich., is beginning work on a factory building, 100x60 feet, to be occupied by the wheel and cattle guard departments, which will relieve the crowded condition of the blacksmith shop.

The Atmospheric Products Company, incorporated some time ago, has completed negotiations with the Niagara Falls Power Company and will establish a plant there. A machine shop and laboratory, 50x128 feet, will be the first building put up.

The Wabash Screen Door Company, of Chicago, which has a factory in Memphis, Tenn., has decided to establish a plant in Minneapolis, Minn. Buildings to cost $150,000 will be erected immediately. There will be engine and boiler rooms, dry kilns, etc.

A company will be organized to purchase about 20,000 acres of hardwood lands in Antrim and Charlevoix Counties, Mich., and build a mill at Boyne Falls. Among those interested in the enterprise are Henry Idema, L. H. Withey and F. C. Miller, of Elk Rapids.

At a meeting of the directors of the Easthampton (L. I., N. Y.) Electric Light Company, Dr. George E. Munroe, C. L. W. Eidlitz, the well-known architect, of New York, and J. S. Osborne were appointed a committee to obtain information as to a site for a plant.

The Mills Machine Company, Lawrence, Mass., in which M. A. Mills is a leading factor, has begun the erection of a foundry and machine shop to cover some 3,000 square feet of land. The company is composed of mill engineers, and it will build paper-making machinery, etc.

Plans for extensive enlargement of the plant of the Sherwin-Williams Company at Pullman, Ill., have been completed. It is said that there will also be a gymnasium, yacht clubhouse and restaurant for the use of the employees. The company manufactures paint, etc.

The Edison Electric Company, of Los Angeles, Cal., proposes to build a new steam plant, enlarge its present water power plant and build a new plant on Kern River capable of developing 20,000 horse-power. A power line will be built from Los Angeles, a distance of 100 miles.

It is reported from San Bernardino, Cal., that the Redlands (Cal.) Electric Light & Power Company is making improvements in Mill Creek Canyon to increase the plant from 2,000 to 3,800 horse-power. Another large power-house will be built in the canyon and two more in Santa Ana Canyon.

Mordecai P. Endicott, chief of the Bureau of Yards and Docks, has invited estimates for the erection of a patternshop at the League Island Navy Yard. An appropriation of $57,500 has been made for the building. It will be two stories, 75x100 feet. Bids will be received until August 2.

Manager Albert Brown, of the Florence, Colo., branch of the Oil Well Supply Company, of Pittsburgh, has left for Boulder to arrange for the immediate construction of the machine shops that the company will build there. It is expected to have the works in operation September 1.

The Garland Nut & Rivet Company, affiliated with the Garland Chain Company, of Rankin, Pa., is about to erect a 700x75-foot plant in West Pittsburgh, to employ 200 men at the outset. John W. Garland is president; Robert Garland, treasurer; Alfred Sang, general manager, and Edgar Dunn, superintendent.

The Northern California Power Company will, it is understood, build a 4,000 horse-power plant on Cow Creek, 20 miles northeast of Redding. The Oregon Water Power & Railway Company has acquired the ownership of the property of the Portland City & Oregon Railway Company, and will, it is understood, spend $5,000,000 in the electrical development of the vicinity of Portland, Ore.

Charles Bechshoft, of Copenhagen, Denmark, has lately been in Davenport, Ia., relative to the heating system of which A. B. Reck, of Copenhagen, is the inventor and patentee. It is likely that the American Reck Heating Company will be incorporated in Davenport, and will do business over the entire United States. G. T. Ahrens has left for Copenhagen in the interests of the proposed company.

It is reported from San Jose, Cal., that the Golden State Automobile Company has purchased the plant of the Christman Motor Carriage Company and will remove to its premises on San Fernando street. H. W. Lupton, manager of the Golden State Company, announces that he has also secured the privilege to manufacture and sell the Christman muffler in that territory. The company will manufacture the Lupton friction transmission motor vehicles.

According to representatives of the American Can Company, its condition is improving, despite the decline in the stock, and the amount of business now being transacted is larger than it was a year ago. The statement is made that the company is carrying out its policy of reducing its plants, which were originally over ninety. These have now been reduced to about 40, and this total it is said will be brought to something like 30. The company is building a large plant at Cleveland, at which several of the smaller plants will be concentrated.

The plant to be erected by the J. L. Mott Iron Works, of New York, in Trenton, N. J., for the manufacture of plumbing supplies, etc., will include the following buildings, all to be constructed of brick and steel: Foundry, 475x80 feet, one story; pattern shop, 160x60 feet, four stories; power-house, 160x60 feet, one story; warehouse, 300x50 feet, two stories; brass shop, 250x50 feet, four stories, and enameling shop, 400x66 feet, one story. The engineers are Adams & Schwab, of Baltimore, Md., who will prepare specifications for the power equipment and special machinery and will take bids.

The United States Pump & Supply Company has been incorporated under the laws of New Jersey, and it is reported as the in-

tention to consolidate under this company "the large pump factories of the country." The Standard Pump Company, of Toledo, O., and the Bean-Chamberlain Manufacturing Company, of Hudson, Mich., have already passed into the control of the new company, which proposes to erect a plant in Toledo. The officers of the new company are: President, Roscoe Bean, of Hudson, Mich.; vice-president, D. J. Nyswander, Toledo; secretary, J. H. Close, Toledo; treasurer, George N. Pomeroy, Toledo.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N.J.

Machinists' Co-operative Association, cor. of Atlantic av. and Boerum pl., Brooklyn, N. Y.

Fine and special machinery and experimental work guaranteed. Wyland Mfg. Co., Williamsport, Pa.

Wanted—An automatic gear cutter to cut not less than 24 in. in diameter, 4 diametrical pitch. Address F. X. Hooper, Glenarm, Md.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Light and medium machinery built to order; estimates furnished on all kinds of machine work. F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa.

Gear and milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears; catalog of small tools free. R. M. Clough, Tolland, Ct.

Specialties Wanted.—Having a complete plant, consisting of foundry, machine and pattern shops and good workmen with excellent materials, we solicit special work; we can employ 20 more men readily. Address Box 679, AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

By a practical man, charge of fine manufacturing. Box 693, AMERICAN MACHINIST.

Foreman, wide experience, open for engagement. T. J. Keller, 286 E. Huron st., Chicago.

Mechanical draftsman, quick tracer, desires position as assistant. Box 685, AMER. MACH.

A mechanical draftsman has two weeks, also every evening, to spare. Box 692, A. M.

Machine shop foreman at liberty; first-class references; good executive ability. Box 642, AMERICAN MACHINIST.

First-class metal pattern maker (understands molding machine) wants position. Box 681, AMERICAN MACHINIST.

Draftsman; young man; have natural mechanical ability, also technical education, with some experience. Box 689, AM. MACH.

Tool designer wants position; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

Practical mechanic and factory superintendent would like to hear from parties wanting a man in that capacity; can give good references. Box 655, AMER. MACHINIST.

Machine shop foreman or superintendent; extensive experience, practical and reliable; 16 years' practice, 7 years as general foreman; A1 reference. Address "Mechanic," Box 691, AMERICAN MACHINIST.

Mechanical draftsman, 31, experienced in hydraulic presses, machine tools, special machinery, light and heavy, 11 years' experience, wishes steady position; best references. Box 683, AMERICAN MACHINIST.

Young man, 21, now employed in drafting room under instructions, desires similar position or tracer, in vicinity of New York city, so that he may attend evening technical school. Box 684, AMERICAN MACHINIST.

A gentleman with years of experience as a works manager is desirous of securing a position with some pushing manufacturing company where ability and practicability are needed and will be appreciated. Address Box 633, AMERICAN MACHINIST.

A widely experienced superintendent and manager of machine works, expert in best shop practice and construction, of reliable executive ability and high-class references, seeks position with progressive concern. Address Y., 635 W. 61st st., Chicago.

Mechanical engineer and expert designer desires change; a technical graduate with 10 years' experience in the design and installation of power plants, power transmission, excavating, conveying and general heavy machinery; have held position of chief draftsman with shop supervision. Address Box 697, AMERICAN MACHINIST.

Mechanical engineer, college graduate, expert in gas engine building, successful designer of large engines for blast furnace, producer, etc., gas, American and European experience, general engineering, modern shop management, seeks position as superintendent, chief engineer or chief draftsman; salary, $200; first-class references. Address Box 686, AMERICAN MACHINIST.

Help Wanted.

Wanted—First-class patternmaker, familiar with machine tool work. Box 674, A. M.

Wanted—Half-dozen good machinery molders. Southern Foundry & Machine Co., Knoxville, Tenn.

Wanted—Men in large cities to take orders for machine tools. Cochrane-Bly Machine Works, Rochester, N. Y.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—Three or four first-class machinists, also one patternmaker. Address Morse Twist Drill & Machine Co., New Bedford, Mass.

Ha! Ha! Only 40c. (stamps taken) for that 65c. hardened 6-inch rule; have a few left; write quick. E. H. Randall, 235 Wood ave., Springfield, Ohio.

Patternmaking teacher wanted in the South; must be a fair draftsman and understand algebra; salary $600 first year. Harry Gwinner, Ruston, Louisiana.

Wanted—A number of first-class patternmakers at once; best wages paid; new shop and machinery. The Balkwill Pattern Works, 970 Hamilton st., Cleveland, Ohio.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Two mechanical draftsmen wanted, with experience on either automatic machines or tools for manufacturing; good wages and steady position. Address Box 682, AM. M.

Wanted—A competent foreman to take full charge of sheet metal drawing, forming and punching department; state wages expected and experience. Address Box 680, AM. M.

Wanted—First-class machinery draftsman, thoroughly competent to design new machinery from ideas furnished. Address The American Laundry Machinery Co., Cincinnati, Ohio.

Wanted—Several good mechanical draftsmen; state age, experience and salary expected; Americans preferred; permanent positions to right men; 30 minutes from New York city. Address Box 688, AMER. MACH.

Wanted—Foreman in machine shop in New England, manufacturing freight and passenger elevators and doing general machine work; employs 40 men. Address, stating age, experience, etc., Box 690, AMER. MACHINIST.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—First-class detail draftsman, experienced on machine tool work; factory 100 miles from Chicago; a first-class man who can command good pay only wanted; married man looking for steady position preferred. Address Box 664, AMER. MACH.

Designer of automobiles wanted in Philadelphia to take charge of drafting department in automobile works; must have a theoretical as well as practical experience in mathematics and gas engine construction; give age, present occupation and salary expected. Box 687, AMERICAN MACHINIST.

Wanted—As instructor in patternmaking in an Eastern school of engineering, an intelligent, young, energetic patternmaker with exceptional knowledge and skill at his trade; good salary. Apply, stating age, nationality, education and experience in detail, "Instructor in Patternmaking," care AMER. MACH.

Wanted—By Blees Military Academy, Macon, Missouri, an instructor in manual training; topics, carpentry, woodturning, forging, chipping, filing, mechanical drawing, machine drawing; the instructor must be unmarried, have successful teaching experience and college education; salary will not exceed $1,000.

Machinist Wanted.—To keep pace with our rapid growth we need an additional number of experienced machinists; we want steady men of good habits, looking for permanent positions; school, home and health advantages of Madison are unsurpassed; write immediately for particulars; state age, experience, etc. Northern Electrical Mfg. Co., Madison, Wis.

Paint and assembling foreman wanted; a competent and experienced foreman for painting and assembling department of an agricultural implement factory; none but thoroughly experienced need apply; must be able to devise plans and methods of getting work out in excellent shape and at the least possible cost; give age, reference and salary expected. Address Box 695, AMER. MACH.

Wanted—An energetic young man with practical foundry experience and executive ability to take position as foundry order clerk in growing manufacturing concern, who are now buying castings from several jobbing foundries but who intend building foundry in near future and want a man in this position who can eventually take charge of the foundry. Box 669, AMERICAN MACHINIST.

We wish to employ at once first-class mechanics, experienced in operating the Gisholt turret lathe, Jones & Lamson turret lathe and the American Tool & Machine Company's improved brass lathe; also a man to take charge of screw machine and chucking lathe department, capable of designing and equipping the machines for special work, and a planer hand on medium heavy work. De Laval Steam Turbine Co., Trenton, N. J.

Wanted—Assistant to the manager, an energetic young man who is familiar with air compressors or gas engines; one who can take charge of office, prepare estimates on complete plants and assist generally in the management of a strictly modern shop; state fully experience, nationality, age, whether married or single and probable salary expected; this is a permanent and desirable position to the right man. Address The Gray-Blaisdell Company, Bradford, Pa.

Wanted—Foreman for a department engaged in the manufacture of a small machine specialty; should be a first-class mechanic, not over 45 years of age, and have had experience on typewriter, gun, sewing machine or similar work; must have executive ability, be thoroughly trustworthy and of good morals; location vicinity of New York; steady position and good wages. Address, giving references, experience and salary expected. G. H. R. & Co., Box 694, AM. M.

Wanted—Experienced foundryman; we are about to erect a thoroughly up-to-date foundry, suited for high-grade machine tool and other work, and require the services of a man as superintendent or general foreman of same; applicants must thoroughly understand foundry practice and be competent to assist in planning same in all its branches; none need apply who are not now holding positions of responsibility in modern foundries; are willing to pay highest salary to right kind of man. Address, stating age, experience, names of past employers, etc., Box 677, AMERICAN MACHINIST.

Wanted—Toolroom foreman; a first-class

man who can take full charge of toolroom employing 20 men; a man who needs only general instructions from the superintendent and has the ability to carry out the work himself thereafter; toolroom fully equipped with all necessary tools for any work required; applicant must be able to lay out a system and see that it is carried out; must be able to make gages of different kinds and have had experience in that line; only a thoroughly capable, industrious, sensible man need apply; shop in Middle West, in city of 20,000; married man, experienced in toolroom of good sized tool shop, preferred. Address Box 696, AMERICAN MACHINIST.

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Abrasive Materials

Abrasive Material Co., Phila., Pa.
Carborundum Co., Niagara Falls, N. Y.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.

Arbor Press

Barnes Co., W. F. & John., Rockford, Ill.
Bartlett, E. E., Boston, Mass.

Ball Bearings

See Roller Bearings.

Balls, Steel

Automobile & Cycle Parts Co., Cleveland, O.
Grant Tool Works, Franklin, Pa.

Bars, Boring

Cleveland Twist Drill Co., Cleveland, O.
Underwood & Co., H. B., Philadelphia, Pa.

Barrels, Steel

Cleveland Wire Spring Co., Cleveland, O.
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Belt Dressing

Dixon Crucible Co., Jos., Jersey City, N. J.
Houghton & Co., E. F., Philadelphia, Pa.

Belt Lacing Machines

Diamond Drill & Mach. Co., Birdsboro, Pa.

Belting, Leather

Shultz Belting Co., St. Louis, Mo.

Bending Machines, Hydraulic

Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Bending Machines, Power
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Reade Mchry Co., Cleveland, O.

Blocks and Tackles
See Hoists, Hand.

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Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
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Chandler & Taylor Co., Indianapolis, Ind.
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Howard Iron Works, Buffalo, N. Y.
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Books, Mechanical
Baird & Co., Henry Carey, Philadelphia, Pa.
Henley & Co., N. W., New York.

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Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., N. Y. City.
Betts Mach. Co., Wilmington, Del.
Binsse Mach. Co., Newark, N. J.
Dallett & Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fosdick Mach. Tool Co., Cincinnati, O.
Franklin Mach. Wks., Phila., Pa.
McCabe, J. J., New York.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Boring and Turning Mills
American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Carborundum
See Grinding.

Castings, Aluminum and Bronze
Christensen Engineering Co., Milwaukee, Wis.
Miami Brass Wks., Hamilton, O.

Castings, Brass
Christensen Engr. Co., Milwaukee, Wis.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Iron
Taunton Loco. Mfg. Co., Taunton, Mass.

Castings, Steel
Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Newark, N. J.
U. S. Steel Co., Everett, Mass.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Centering Machines
Bement, Miles & Co., New York.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Chains, Driving
Automobile & Cycle Parts Co., Cleveland, O.
Boston Gear Works, Boston, Mass.
Bridgeport Chain Co., Bridgeport, Conn.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Whitney Mfg. Co., Hartford, Ct.

Chucking Machines
Cleveland Mach. Screw Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Goodell-Pratt Co., Greenfield, Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankford, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
The E. Horton & Son Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Coil Clutch Mfg. Co., New York.
Faneuil Watch Tool Co., Boston, Mass.
Jacobson Mach. Mfg. Co., Warren, Pa.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

Compressors, Air
Blanchard Mach. Co., Boston, Mass.
Chicago Pneumatic Tool Co., Chicago, Ill.
Christensen Engineering Co., Milwaukee, Wis.
Gray-Blaisdell Co., Bradford, Pa.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Rand Drill Co., New York.

Consulting Engineer
Thompson, Hugh L., Waterbury, Conn.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.

Correspondence Schools
See Schools, Correspondence.

Counters, Machinery
Veeder Mfg. Co., Hartford, Conn.

Countershafts
Builders' Iron Fdry., Provi., R. I.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Reeves Pulley Co., Columbus, Ind.
Wheaton Mach. Co., Boston, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.

Couplings, Shaft
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.

Cranes
Brown Hoisting Mach. Co., N. Y. City.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutting off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Cyclometers
Veeder Mfg. Co., Hartford, Conn.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
Wold & Co., Torris, Chicago, Ill.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

Drafting Machine
Universal Drafting Mach. Co., Cleveland, O.

Drawing Instruments
Keuffel & Esser Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Dwight Slate Mach. Co., Hartford, Conn.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Dust Collectors
Allington & Curtis Mfg. Co., Saginaw, Mich.

Electrically-Driven Tools.
Clark, Jr., & Co., Jas., Louisville, Ky.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Howard Iron Wks., Buffalo, N. Y.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Stover Engine Wks., Freeport, Ill.
Struthers, Wells & Co., Warren, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Chandler & Taylor Co., Indianapolis, Ind.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Exhaust Heads
Burt Mfg. Co., Akron, O.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Filters, Oil
Burt Mfg. Co., Akron, O.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dwight Slate Mach. Co., Hartford, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.
Russell, R. M., Binghamton, N. Y.

Grinders, Center
Browning Mfg. Co., Milwaukee, Wis.
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Russell, R. M., Binghamton, N. Y.
Safety Emery Wheel Co., Springfield, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.

Grindstones
Cleveland Stone Co., Cleveland, O.
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Hoefer Mfg. Co., Freeport, Ill.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Merrill Bros., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburg Shear Knife & Mach. Co., Pittsburgh, Pa.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Enginering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Insurance, Boiler
Hartford Stm. Boiler I. & I. Co., Hartford, Conn.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply So., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rowbottom Mach. Co., Waterbury, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Wyke & Co., J., E. Boston, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Molds, Hammer and Vise Jaw
Field, Chas. H., Providence, R. I.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Shop
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Stevens & Co., Milo B., Washington, D. C.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Field, Chas. H., Providence, R. I.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Balkwill Pattern Works, Cleveland, O.
Gobeille Pattern Co., Cleveland, O.
Lorentz & Evarts, Hartford, Ct.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Planers
American Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Presses, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.
Wold & Co., Torris, Chicago, Ill.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburg Shear Knife & Mach. Co., Pittsburg, Pa.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.

Reamers—*Continued*
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting.
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Nutter, Barnes & Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
Pratt Institute, Brooklyn, N. Y.
Purdue University, Lafayette, Ind.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Dawson, John H., Chicago, Ill.
Fairbanks Co., New York.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford. Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.
York Mchry. Co., S. M., Cleveland, O.

Separators, Oil
American Tool & Mach. Co., Boston, Mass.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls. Pa.

Shapers
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New Haven.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburg Shear Knife & Mach. Co., Pittsburg, Pa.
Reade Mchry. Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
Herman Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriache & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland. O.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
American Tool & Mach. Co., Boston, Mass.
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Foster, Walter H., New York.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.
Gray & Prior Mach. Co., Hartford, Conn.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Howard Iron Wks., Buffalo, N. Y.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automobile Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

The Electrical Tabulating Machine Applied to Cost Accounting.

For some time students of statistics have been very greatly interested in the electric tabulating machine, and especially in its work in connection with the tabulation of the statistics of agriculture from the census of 1900. The purpose of the machine is to do away with the enormous amount of clerical work involved in analyzing the data which are turned into the Census Office in the enumerators' schedules. To accomplish this the data recorded on the schedules are first transcribed to punched cards, of which the various holes, by their location, record the answers as given on the schedules. When these cards are fed through the tabulating machine it adds the various items. The specially valuable feature of the system is that by it the cards, once made, may be separated into groups and the additions be made upon any basis that may be desired. For instance the cards might be grouped according to States and if then run through, the resulting figures would give, among other things, the totals of the various crops produced and the acres devoted to each, and by dividing one by the other the comparative productivity of the soil of each State could be determined. Again, the cards from the South could be grouped in accordance with the race of the farmer, and the comparative productivity of farms owned by whites and blacks be thus determined.

This machine has been utilized for some time in the accounting department of the New York Central & Hudson River Railroad, and the inventor has now adapted it to the work of factory cost accounting.

The base of the system is the punched card which, as arranged for a particular factory, is shown in Fig. 1.

Each workman turns in daily a time slip, which shows his number and the time, in hours and quarters, during which he was engaged in working on different jobs or different parts of different jobs. The number of the job shows that he is working, for example, on a certain lot of knitting machines, the lot number showing that it is the third lot of these machines which the factory is making. Other facts recorded on the time slip are whether the work is done by day labor or under contract, and the particular part of the knitting machine on which the employee is working. Many operatives, of course, are engaged the entire day, or parts of the day, upon repairs. In such cases the number of the job is a fixed one, and indicates that the man is engaged, for example, in repairing certain kinds of shop tools. The entire time of every operative must be accounted for, and is chargeable to some particular job of productive labor, or else to a number corresponding to a certain classification of shop expense.

The time slips are handed in at the end of each day, and are then transcribed to the punched record cards, which are 3¼ inches wide by 5⅝ inches long, printed as shown in Fig. 1.

All the cards for a given day's business are punched in the first three rows, as follows: First, a hole to indicate the year; next, a hole to indicate the business month to which the account related; then in the top of the third row a hole to indicate the first, second, third, fourth, or fifth week of that month's business, and, finally, a hole to indicate the day of the week. It will readily be seen that the holes in these three columns for any one day's work must be the same for all the cards relating to that day, and therefore many cards can be perforated at once. This operation is quickly accomplished by using a simple device known as the "gang punch," shown in Fig. 2.

The record for each individual operative is next transcribed to the card by perforating it with a key punch shown in Fig. 3 with a card in place. The facts recorded are these:

1. The number of the operative.
2. The number of the job on which he worked.
3. Whether the work was done by day labor (D), by contract (X), or related to shop expense (Sh).

01	1	1																																		
02	2	2	Man			Job					Lot	Part			Time			Rate		Cost Labor			Cost Burden		
03	3	3	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04	4	4	1	1	1	1	1	1	1	D	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
05	5	5	2	2	2	2	2	2	2	X	2	2	2	2		2	2	2	2	2	2	2	2	2	2
06	6	S	3	3	3	3	3	3	3	Sh	3	3	3	3		3	3	3	3	3	3	3	3	3	3
07	7	M	4	4	4	4	4	4	4		4	4	4	4		4		4	4	4	4	4	4	4	4
08	8	T	5	5	5	5	5	5	5		5	5	5	5		5		5	5	5	5	5	5	5	5
09	9	W	6	6	6	6	6	6	6		6	6	6	6		6		6	6	6	6	6	6	6	6
10	10	T	7	7	7	7	7	7	7		7	7	7	7		7		7	7	7	7	7	7	7	7
11	11	F	8	8	8	8	8	8	8	8	8	8	8	8		8		8	8	8	8	8	8	8	8
12	12	F	9	9	9	9	9	9	9		9	9	9	9		9		9	9	9	9	9	9	9	9

American Machinist

FIG. 1. THE RECORD CARD.

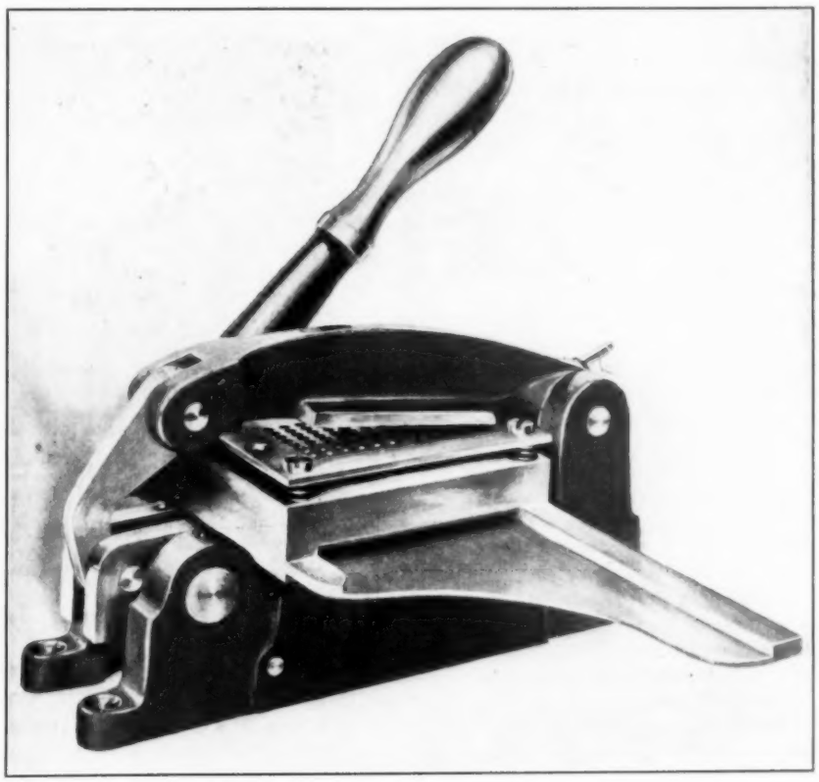


FIG. 2. THE GANG PUNCH.

4. The lot number. It will be noticed that only ten spaces are provided for this, but it never happens that there are more than two or three different lots under way at the same time. Therefore hole 1 in this column may indicate the first, eleventh, or twenty-first lot. The date, however, as punched in the first three rows of the card, makes any confusion from this impossible.

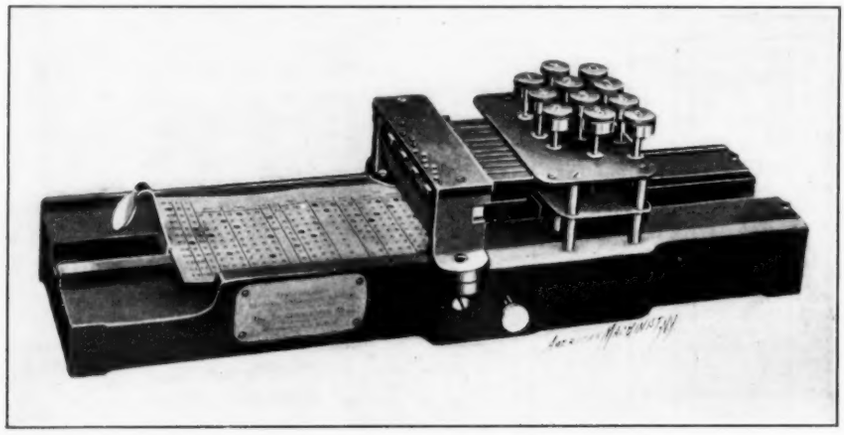


FIG. 3. THE KEY PUNCH.

5. The number of the part of the machine on which the operative is working.

6. The total number of hours and quarter hours consumed.

Taking the columns of the card shown in Fig. 3 in order, they show that the work recorded was done in 1902, seventh month, fifth week, Saturday, by workman No. 361 on job 2074, etc. When the operative's time, during any one day, is divided between two or more jobs, or two or more parts of the same job, a separate card is punched for such job or part.

This completes the transcription of the record to the punched card and gives all the data relating to the time spent by the operatives on the work in the shop. As soon as the time slips have thus been transcribed to punched cards they are filed according to the operatives' numbers, until the end of the week. In a similar way the punched record cards are sorted in numerical order, according to the number of the operative.

At the end of the week the time slips for each operative are aggregated for the total number of hours for which that individual is entitled to pay, and these figures are set down on a payroll. The punched cards corresponding to each operative are then run through a tabulating machine, and the total hours thus obtained checked with the pay roll. If a discrepancy occurs between the payroll and the number of hours as shown by the punched cards, the cards for that operative are checked back to the time slips and the error located, either in making the addition from the slips or in punching the cards. In this way is secured the absolute accuracy of the punching of time on the different cards, and also a complete check on the addition of the time slips.

At the end of each week the cards are arranged according to the rate of pay. For example, bring together the cards representing operatives Nos. 245, 293 and 356, and all others who may receive the same rate of pay, say 25 cents per hour. All the cards corresponding to this particular rate of pay are then sorted according to the number of hours represented. This results in groups of cards of the same rate of pay and number of hours, as, for example, cards corresponding to the rate of 25 cents an hour and ten hours' labor. For such group of cards a gang punch is set to perforate 25 cents in the column for rate of pay, $2.50 for cost of labor, and, if the burden is apportioned on a rate of 10 cents an hour, $1 for burden. These cards are then gang punched with great rapidity. Taking next the cards for operatives receiving 25 cents an hour, working 10¼ hours, the gang punch is changed to give the proper labor cost and burden, and these cards are then punched. In this manner all the cards are perforated to show the rate of wages and the labor and burden cost.

If preferred, the card can be completely punched in the key punch by recording in each case the rate of pay, the total amount charged to labor, and the amount charged to burden. This method is to be preferred when the total number of cards per week is comparatively few; the method of sorting and gang punching is to be preferred when the total number of cards is comparatively large.

The cards are then sorted according to job and lot numbers, are run through the tabulating machine shown in Fig. 4, and and the total cost of labor and of burden for the week's business is ascertained and charged up against each job and lot, and the cards filed away under such job and lot number.

The machine shown in Fig. 4 is operated by placing the cards in succession on the bed of the press at the right and depressing the handle. The movable upper part of the press contains an arrangement of spring backed needles, a needle being located for every possible position of the holes on the cards. Below each needle is a mercury cup filled with mercury. As the handle is depressed, those needles which find holes below them pass through and enter the mercury, thereby making electrical contact, completing their circuits, and operating the adding

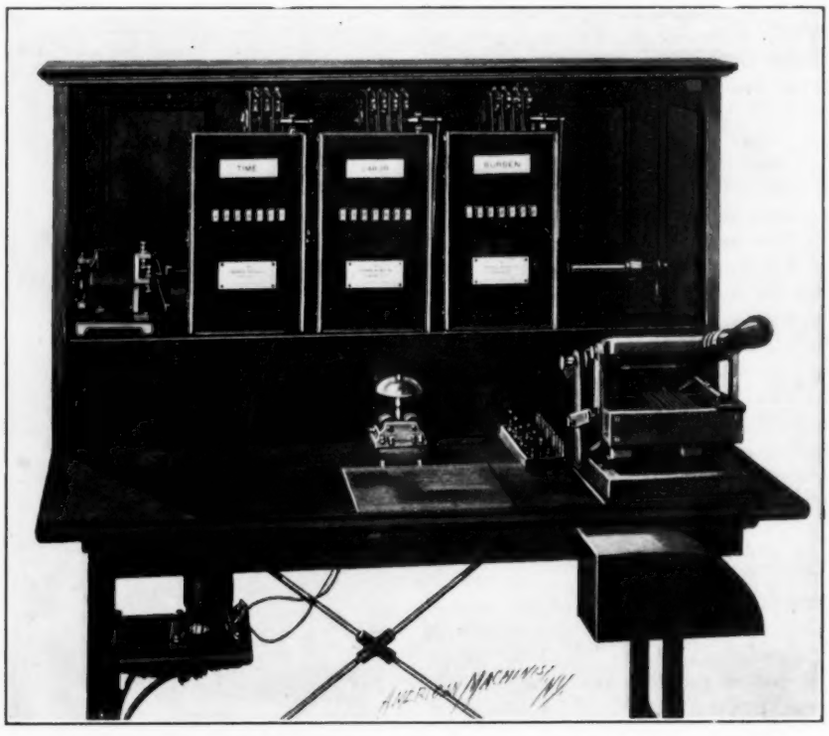


FIG. 4. THE TABULATING MACHINE.

mechanism. The totals of time, labor and burden are recorded by the register wheels which are clearly shown in Fig. 4.

On the completion of any lot of machinery the corresponding cards are withdrawn from the files, sub-divided according to the numbers of the parts, and are run through the tabulating machine. In this way the hours' labor and burden cost for each part are ascertained.

If the manager of the works should find that the expense of a certain job is too high, by this system he can analyze the cost by ascertaining the cost of each part, and if he has reason to think that the cost of any part is too high, he can analyze that by sorting the cards according to the rates of wages, so as to observe the proportion of high and low priced labor engaged in the manufacture of that part. He obtains the total number of hours of work expended in making such part, and therefore knows the average rate of the labor employed upon it. He also can ascertain immediately who the operatives were, and the number of hours consumed, from the time record of each. In other words, having before him the cards representing the labor employed in the manufacture of that part he has a complete history, which he can analyze first from one point of view and then from another, for it is a very simple matter to shift the cards from one grouping to another. If at any time the amounts charged to shop expense should seem high, the manager can analyze this in similar manner.

The time reports are filed away according to the number of the operative, and in this way a complete and consecutive record of each man's service is maintained, the punched cards being in the nature of a card index to such time reports.

It will, of course, be apparent that in the case of manufacturing an article on which expensive machines are used, a report can be obtained from such machines similar to the reports from the operatives. If desired, a different rate of shop expense can be charged for different classes of operatives, according to the machine tools used.

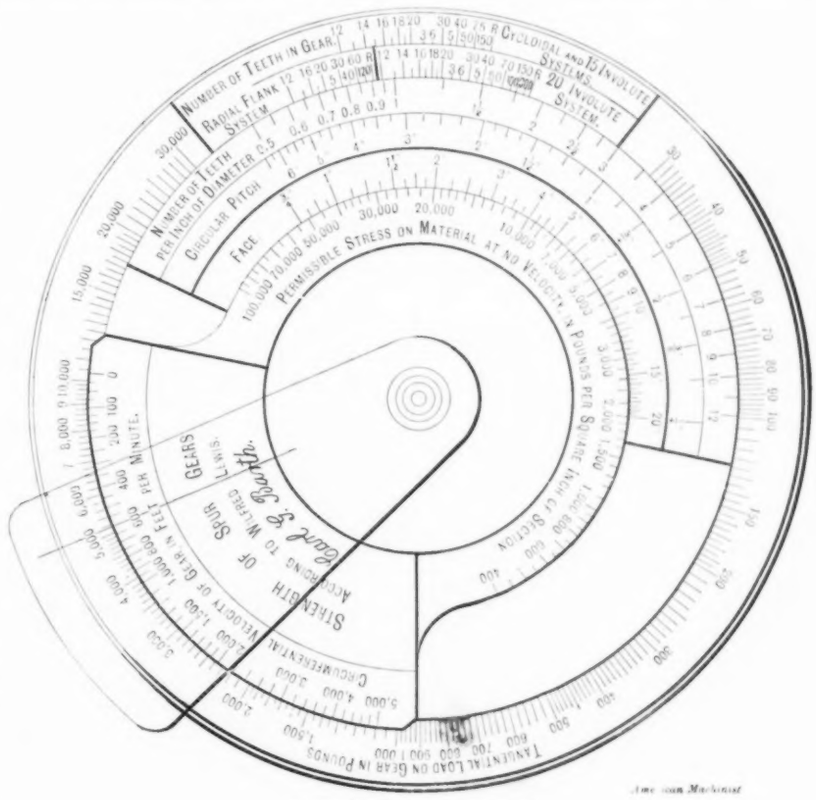
As stated above, the form of card shown in Fig. 1 was intended for a particular shop, and in this case it was not desired to go into the costs of individual operations, although that could be done, as the workmen engaged in the different operations are recorded. If desired, it would, of course, be very simple to provide the card with another column or two to indicate the kind of work done, milling, planing, drilling, etc. In that case we would be able to analyze directly the cost of the labor for the different kinds of operations without any reference to the numbers of the individuals. Or, if the men's numbers are given according to the department in which they work; that is, all men numbered one hundred in milling, all numbered two hundred in planing, all numbered three hundred in drilling, etc., the cost could be readily analyzed for the different kinds of op rations.

Any number of modifications of this kind can, of course, be worked out to meet individual requirements. It would, for example, be easy to arrange for a separate report for the operations on the different machines, so that the machine expense could be handled entirely independently of the expense of labor.

The machine is the product of The Tabulating Machine Company, of 1054 Thirty-first street, Washington, D. C.

Barth's Gear Slide-Rule.

Mr. Carl G. Barth, of Swarthmore, Pa., has recently developed a special circular slide rule for solving problems in gearing in accordance with the now standard formula of Wilfred Lewis. The instrument, which is shown in the accompanying illustration, takes account of all the factors in the Lewis formula, including those for the velocity, the number of teeth, and the curve system by which the profiles of the teeth are determined. It may also be used with equal facility for pitches given by either the diametral or circular pitch system. The instrument consists of three superimposed disks—the lower, middle and upper—and a celluloid rider with a radial line to facilitate the setting of the disks.


Number of Teeth in Gear
Radial Flank System
Number of Teeth per Inch of Diameter
Circular Pitch
Face
Permissible Stress on Material at No Velocity in Pounds per Square Inch of Section
Cycloidal and 15 Involute Systems
20 Involute System
Strength of Spur Gears According to Lewis.
Gears
Minute
Velocity of Gear in Feet per
Circumferential
Tangential Load on Gear in Pounds
Barth's Slide Rule

BARTH'S GEAR SLIDE RULE.

The illustration shows the instrument set to determine the working load of a spur gear on the 20-degree involute system, having 40 teeth of 1½ diametral pitch, 5-inch face, running at 600 feet peripheral speed, the material being supposed to be capable of carrying a static load of 8,000 pounds per square inch.

To solve this problem, 1½ of the diametral pitch scale on the middle disk is set opposite 40 of the 20-degree involute scale on the lower disk; 8,000 of the permissible static stress scale on the upper disk is then set opposite 5 of the face scale on the middle disk, and opposite 600 of the velocity scale on the upper disk is read 5,200 pounds working load from the load scale on the lower disk—the reading being indicated by the mark on the rider.

In this case the use of the rider is not necessary, but had the cycloidal or 15-degree involute system of teeth been intended, or had the circular pitch been used, the rider would have been used in setting the pitch opposite the number of teeth.

An Alleged New Nickel-Steel Alloy.

Some time ago it was announced that Dr. Guillaumey, of Sèvres, had discovered an alloy of nickel and steel which did not expand when heated, nor would it rust or oxidize. Respecting this discov ry, the *New York Times* quotes Dr. Thomas B. Stillman, professor of chemistry and metallurgy at Stevens Institute of Technology, as saying:

"A short time ago a Pittsburgh company claimed to have found an alloy composed of small quantities of tungsten chromium and molybdenum, 5 per cent. of nickel, and the rest steel. They submitted a specimen

about the size of a 10-cent piece to me for analysis.

"I analyzed the piece and found that the hardness had been produced by the absence of phosphorus in the steel, and that there was no tungsten, little chromium, and about 88 per cent. nickel in it. Of course it did not rust, but it certainly did expand.

"Nickel follows the same laws of expansion by heat that steel does. The coefficient of expansion of steel by heat is .001079 and of nickel .001279. An alloy made of these metals must expand by heat, the nickel showing more expansion than the steel. It is true that non-oxi 'izable alloys of steel and nickel have been made, but they are entirely too expensive for general use, since the amount of nickel required to prevent oxidization or rusting in an alloy is over 75 per cent., and nickel sells for 50 cents per pound, while open-hearth steel is worth 1½ cents per pound.

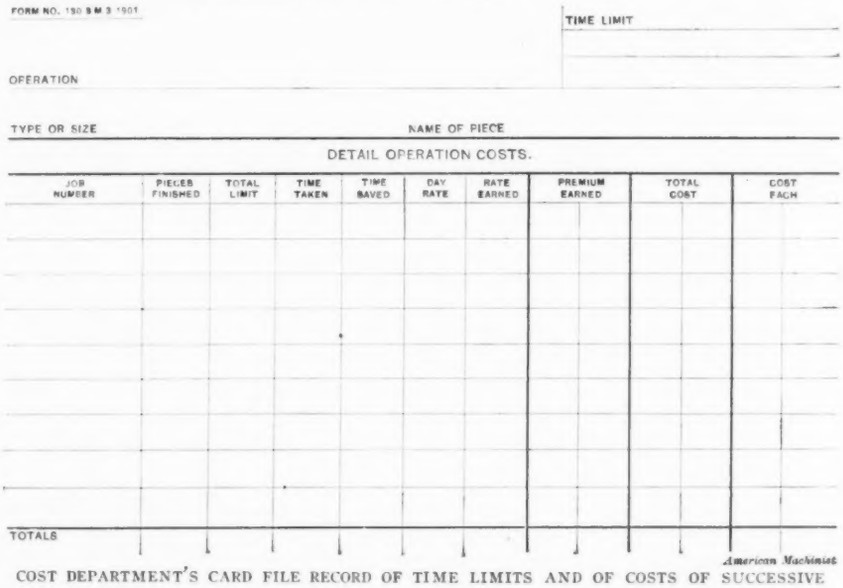
"I do not believe that an alloy of nickel and steel will ever be made which will have the properties claimed for that alloy made by Dr. Guillaumey."

The Premium Plan at the Blank Blank Engineering Works.

A discriminating reader has asked for fuller information about a feature of the methods described in the article under the above title at page 906. The article conveys the impression in one place that the book of job-ticket stubs is in the possession of the foreman and in another place that it is in the possession of the cost department. We have referred the inquiry to the cost accountant of the Blank Blank Engineering Works, and give his reply as follows:

The question raised is very simple, but it is one of those points which must be arranged to meet the shop conditions in order to avoid complications. If conditions are such that each foreman has a clerk, the clerk can give out the premium jobs to the workmen, keep a record of the premium hours worked on each job on the stubs, as was described, or the hours can be kept on a pad by simply keeping the job numbers in numerical order. Jobs could also be checked from the time slips at the end of each pay period in the time keeping or cost department. This method, however, takes more time, especially when the employees are paid weekly, as in our case, because the time-keeper would then have to go through several pays in order to get the time slips on each job. It only takes our clerk about two hours to copy the premium hours from time slips to the stubs or pad each day, and when the job is turned in completed it is then checked in a very short time. The stub is simply a record for the foreman in case the workman loses the original or the foreman desires to know when he gave out a certain job to answer inquiries he might receive from the office, etc. In fact, the stub is simply for the foreman's information. It is very seldom referred to and not used by the cost department in any way.

I think your correspondent was confused by the explanation of the premium list which of course originates in the cost department, although it is a permanent record of the premium limits, names of pieces, operations, sizes and types of the work made, as with piece-work lists. The limits are also entered on cards shown in the accompanying illustration, which were not shown in the previous article and which form the cost department's card file record. Completed jobs are entered on these cards at the end of the pay period and they answer several purposes. At the upper right-hand corner is the record of the limit time and in the columns below is an excellent record of detailed operation costs. The cards also give comparative records of different workmen on the same operation and serve as a check on the correct making out of the job tickets. This card is not absolutely necessary, but I look



COST DEPARTMENT'S CARD FILE RECORD OF TIME LIMITS AND OF COSTS OF SUCCESSIVE LOTS OF PARTS. ACTUAL SIZE 4x6 INCHES. THE REAR SIDE IS RULED IN COLUMNS LIKE THOSE SHOWN.

clerk's hands, as do also all of the time slips. He keeps a record of jobs issued by the foremen on a pad and never sees the stubs at all. He could just as well do this for all departments, or he could enter them all on the stubs by working two job books alternately for the foremen who make out their own premium jobs. As this clerk issues the job books to the different departments in numerical order, he can very easily prepare his lists of numbers accordingly.

With the X Y Z Company, with whom I was formerly engaged and who, perhaps, complete more piece-work contracts and premium jobs than any other company, I had the checking all done by the cost department section offices at the end of each pay period. They complete about 10,000 jobs per month and pay their employees semi-monthly, and this work requires very little time. The arrangement, however, would not be as satisfactory with us as our present plan.

upon the information contained on it as very valuable and well worth the small expense of keeping it up.

The limits may be made out for each group of machines in a blueprint, book, or on cards for the information of the person who makes out the job tickets. This of course has only to be done once, just as with a record of piece-work prices. The checking of jobs with daily time slips is also done just as with the piece-work system.

With this company I had the premium jobs issued for departments on the first floor by the general foreman's clerk because his office is located on that floor. As the job-ticket books for these departments are in his hands, he transcribes the premium hours from the daily time slips to the stubs. On the other floors the foremen issue their own job tickets, and, upon completion, they go through this

Your inquirer goes on to say that there are many points that present serious difficulties. I have had charge of the piece-work and premium systems of three companies during the past nine years. They have, during that time, completed approximately 1,000,000 piece-work and premium jobs, and, surely, if anyone is in position to see the difficulties that might arise, I am, and I can frankly say that when I changed several large X Y Z departments from piece to premium work the workmen welcomed the change very heartily. It is a recognized fact among workmen that the premium system is more favorable than piece work. This company never worked piece work, but our employees now object very seriously to working day work on special jobs on which no time limits are made. If your correspondent will point out any difficulties I can prove that they are imaginary by actual experience. The

inspection systems with the X Y Z Company and this company are undoubtedly as rigid as any, and surely if their product was inferior to day's work product, the premium system would be thrown out in a hurry. This system undoubtedly has a tendency to make workmen more careful than day's work, because their time is more valuable, and, if a job is spoiled, they must replace it by day's work and their earnings are thereby decreased.

Cracks in Steel.

BY E. R. MARKHAM.

If a piece of tool steel having in itself no great commercial value, say 20 or 25 cents, is made into a tool, or a part of a machine or apparatus, costing in labor $25 the steel is then very valuable, and it

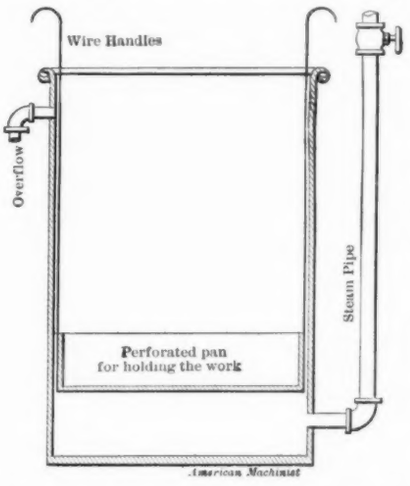


FIG. 1. REHEATING TANK FOR HARDENED TOOL STEEL.

means quite a loss to the manufacturer if it is cracked and spoiled.

When we speak of cracks in steel our minds naturally turn to the hardening department. It never occurs to the average man that it is possible to crack a piece of steel in any way except in the necessary operations of hardening and tempering. I am well aware that a large amount of steel is spoiled every year through carelessness in the various hardening departments of the different shops throughout the country, but I believe that a greater amount is spoiled on account of imperfect facilities for doing the work, and an imperfect knowledge on the part of the operator of the nature and peculiarities of steel.

A man may heat a piece of work very carefully; his heat may be "just right" so far as temperature goes, it may be uniform throughout; he may dip it in the bath in the most scientific manner, yet if he fails to reheat the piece on taking it from the bath to "take the strains out," or, in other words, to heat the surface of the steel sufficiently to allow it to conform in a measure to the changes that take place in the interior of the piece *after* the outside portion is hard and unyielding, the piece is very liable to crack—that is, if it is of a diameter larger than ½ inch.

The reheating of the outside of the piece may be accomplished in several ways. The most common method is by holding over a fire or in a blaze until the surface is heated to a temperature that makes it impossible to hold the hand on it, yet not hot enough so that any of the temper colors are visible.

When in charge of a hardening plant, where hundreds of bicycle cones were hardened each day, I found that it took considerable time to reheat the cones to a point that removed the liability of their cracking when each piece was heated separately after hardening. A large tank was rigged up having a perforated pan in the bottom with wires for drawing it up as shown in Fig. 1. The tank was filled with water to within 4 inches of the top, a steam pipe was connected with the tank and the water was kept at the boiling point. As soon as a cone was hardened it was dropped into this tank and the temperature of the boiling water was found to be about right to reheat the cones to a point that prevented their cracking. Some hardeners claim the above described operation unnecessary, but I think it a very wise precaution to take.

I have known milling machine cutters and similar tools to be cracked by heating in a forge where the direct blast struck the teeth, causing, when the air was hot, an unnecessary amount of heat and then the next moment a cold blast would strike them, causing them to cool suddenly. This sudden expansion and contraction of the steel at the point where the teeth joined the solid part of the cutter would make them crack at that point.

A milling machine cutter made from a piece of steel cut from a bar and machined to a finish without annealing after blocking out is very liable to crack when hardened, particularly if it be of an odd shape, as shown in Fig. 2. If annealed in the bar the steel works soft, but such annealing does not eliminate the liability of cracking

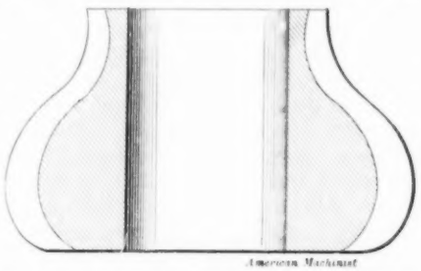


FIG. 2. A CUTTER LIKELY TO LOSE ITS TEETH IN HARDENING.

when hardened, as explained in my article at page 753.

If it is not found possible to anneal after blocking the mill to shape, the next best method is to heat the cutter to a red heat uniformly throughout, take it from the fire and allow it to cool until every trace of red has disappeared, when it may be put in the fire again and brought to the proper hardening heat, and hardened. The bulky part or body of the mill has a tendency to contract in the direction of the hole, while the teeth, being thin, harden first and cannot alter their shape very materially, but the body continuing to contract unevenly after the teeth become rigid goes away from the teeth at the heaviest part of the body, and part of them will be found cracked or broken off and lying in the bottom of the tank. The first heating and cooling to a black gives the steel a chance to, in a measure, contract while the teeth are pliable.

Dipping a piece of steel of uneven proportions in the bath in such a manner that the thinner portion strikes the bath and becomes chilled before the heavier parts will cause it to crack, as the thin part becomes rigid and the heavier part as it changes shape attempts to draw the thinner.

But the hardness is not always to blame because steel is cracked, as I have seen in a certain shop which I was requested to visit to see what was the matter with their steel or method of hardening, as nearly 100 per cent. (all) of their product in a certain line of work was found to be cracked. An examination of the work as it came from the hardening bath showed that not a piece was cracked, but after grinding every piece was cracked.

The pieces referred to were rectangular in shape; they were ground on a surface grinder of the type known as a dry grinder—that is, there was no provision for water to run on the piece while being ground. An investigation of the wheel showed that it was altogether too fine for the work, and that it was badly glazed. By substituting a coarse, free cutting wheel, kept free from glaze, the trouble was eliminated.

The reasons mentioned here are not the only ones causing steel to crack, but they are among the more common ones and those that may most easily be avoided.

The Importance of Quick Delivery in Foreign Trade.

The necessity of making prompt shipment of goods when catering for an export trade becomes every day more apparent. The ability to comply with this requirement has more than once—indeed, on many occasions—decided a contract for engineering work in favor of United States manufacturers and against British exporters.

Thus, for instance, the Cape Government has strongly shown that for railroad material it favors America. The impossibility of obtaining quick delivery from most British houses largely accounts for this. It is estimated that, as a rule, British firms ask between three and four times as long for delivery as the Americans do. It does not need much discernment to discover that in the rapid development of a revived country time is everything. Indeed, in such cases, time is, as the lawyers

say, of the essence of the contract, and any firm that cannot make quick delivery is ruled out of the running. Price is not always everything, and the question of delivery will be one of the leading factors in the South African trade.

Perhaps some of your readers were brought into contact with Sir Charles Elliott, the Commissioner for the Cape Railroads, when he was in the States recently, making a series of quiet investigations with a view to finding out the best equipped places for executing contracts. He had been through the great works of England, Continental Europe, and then he went to the United States, and it is no particular secret that he left America highly impressed with the equipment he saw there. A practical, keen man like the commissioner, an expert high in the confidence of Lord Milner, is not likely to forget that fact when the time comes.

Amid all the controversy that has taken place over the employment of American locomotives in Egypt, one fact stands out unmistakably, viz., the expedition with which the American firms were able to execute orders. This is not open to dispute and the main points are clearly told in Lord Cromer's report to the British Government. On two occasions when British and American firms entered into competition the former offered to complete the orders in forty-eight and ninety weeks, respectively. The Americans offered, on the other hand, to deliver in eighteen and thirty-five weeks if the Egyptian designs were followed, or in twelve and thirty weeks if certain changes in the designs were allowed. The latter condition is explained by the standardization of type. But apart from that the comparison between eighteen weeks and forty-eight and thirty-five weeks and ninety is remarkable. Again, in a further case mentioned in the official report, in which tenders were invited for fifty locomotives, the only American firm that competed offered twenty engines in twelve weeks, while the shortest time offered by a European firm was forty-eight weeks.

The same necessity for prompt delivery of machinery exists in Spain. I was reading only the other day a dispatch from the British consul at Gijon, Corunna, on the supply of machinery from the United Kingdom. He finds that the British position is not satisfactory and this is largely due to the length of time demanded for filling orders. An instance may be cited where tenders were recently asked for for the supply of an 80-ton crane for the new harbor works at the port of Musel, when some British firms proposed delivery in nine months and one firm in twelve months, while a French house guaranteed delivery in six months and obtained the order in consequence. There are many instances of a similar character which militate against British machinery being favored. It is clear that to succeed in the Spanish market the exporters must give quicker and cheaper delivery and issue up-to-date catalogs by changing the antequated system of weights and measures and making all trade literature intelligible to foreigners.

Information reaches me, too, from buyers in Mexico of the delay in the execution of orders from England. Orders from Mexico, it is urged, should certainly be filled in, say, three months, but it is often double that before shipment is advised. This has more than once been the cause of important orders being sent to the United States or to some European market where the order has been filled at once.

Last winter a meeting of merchants and manufacturers was held in London at the offices of the Chamber of Commerce, at which Mr. Bell (the British commercial agent in the United States) attended. It was a gathering of practical business men and this matter of quick delivery was threshed out. One of the principal speakers wanted to know why Americans were able to deliver in six weeks such an article, for example, as rope, whereas delivery by England was often delayed for six months. He found that Britain had been cut out of the rope trade in South America by the United States, and the same thing was happening in other lines. The commercial agent was asked if he could explain why the United States makers were able to make quick delivery, and the reply was that their promptness was due to their more up-to-date machinery and to the men working piece work. This was followed by the statement of another manufacturer that he had introduced such up-to-date machines and his men promptly struck. Not being wealthy, the manufacturer could not afford to run the risk of losing his contracts, and so he had to withdraw the machines and take his men back.

Now, that sort of thing is going on in many places, only we don't hear of it, and while workmen can boss their employers there is really nothing more to be said. Only trade is steadily leaving England. That is all. F. C. C.

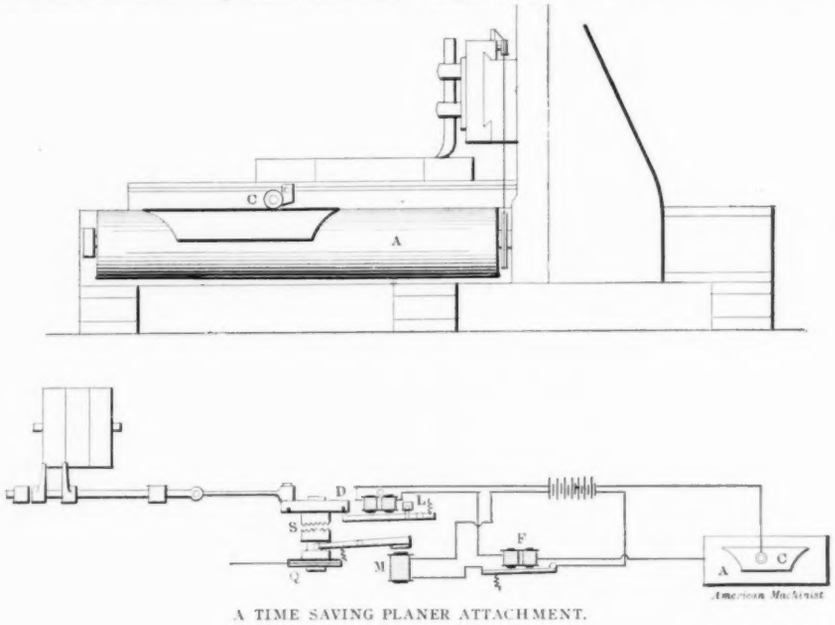
London.

A Time Saving Planer Attachment.

BY H. A. COOMBS.

A unique scheme for saving time in planing was devised by Mr. P. R. Allen, of London, and is shown in the accompanying sketch, which is taken from an English patent granted to him in 1883.

The object is to avoid the necessity of "planing air" when the work is of varying dimensions longitudinally. Instead of the length of stroke of the planer being a fixed amount determined by the longest dimension of the piece to be planed, it constantly varies as the shape of the work varies, and reversal takes place on every stroke just as soon as the tool finishes its cut. The belt-shifter is controlled by electromagnets, the circuit of which is closed whenever a metallic roller mounted on the planer table passes off an insulating pattern which is supported on a metal cylinder mounted parallel with the bed. The pattern, of course, conforms to the work in hand, and the cylinder *A* is rotated step by step by a connection to the saddle. From the diagram of connections it will be seen that when the circuit is closed through the roller *C* and cylinder *A*, the relay magnet *F* closes the circuit of the magnet *M* which throws clutch *S* in, thereby connecting pulley *Q*, which is constantly rotated by a belt, with the crank disk *D*. This latter, through the connecting rod and sliding bar, shifts the belts. The magnet at *O* operates a stop device to prevent the crank disk from running too far. Its armature, which is provided at its end with a projection to engage recesses in the crank disk *D*, moves slowly when the magnet is energized, by reason of the dash-pot *L*, thus



A TIME SAVING PLANER ATTACHMENT.

giving *D* time to get started and carry the recess out of the way of the engaging projection on the armature.

[If the grooved pulley at the end of the cylinder *A* were of the same diameter as the cylinder, the pattern could be easily laid out direct from the work, and if, as we presume, paper could be used for it, its preparation would be a small matter.—Ed.]

Economy in the Foundry.*

BY P. R. RAMP.

Economy is something that is essential in carrying on a business of any kind. The foundry business is no exception to the rule, and at no time is there an opportunity for so much thought and study along this line in our industry as now. In our efforts to cut expenses we sometimes begin at the wrong end, and, as the old saying is, "we spend a dollar to save a cent." During my experience as a foundryman I have heard many men express their views as to cheapest methods of production. While I have often been able to profit by suggestions I have listened to some arguments which were amusing.

In order to produce good work, work that must come up to given specifications, we must use good material. I have a personal dread of cheap blacking, cheap foundry flour, poor molding sand, soft coke, poor iron, etc. A poor grade of material can be purchased for nearly one half the cost of a better and more suitable article. Yet it is generally economy in the end to purchase the best, as the reduction in loss of bad castings will in many cases exceed what is gained by the reduced price of the cheaper material. The following are some of the materials that are often brought to our notice as something that can be bought cheaper and will save us money. For instance, a foundry flour at one half what the regular supply is costing us, yet when a carload is received we find it is necessary to use about twice as much as we take of the old flour to do the same amount of work. This is detrimental in more ways than one. In making cores or dry-sand molds, the more flour is used in the sand mixture, the more gas there is generated. And the more vegetable matter that will produce an excessive gas, the greater possibilities there are for a cut, scab or a blow, which results in a bad or dirty casting. The greater the amount of flour we are forced to use in order to make strong cores or molds, the more they will swell while drying. This causes them to vary in shape and size.

Another item is "plumbago," "blacking" or "dry sand facing." We may be paying 4 or 4½ cents per pound for a lead that is doing good work and peeling the castings in a very satisfactory manner, when along comes a "supply man" and induces the purchasing agent to buy a carload of a cheaper lead, say for 2½ cents per pound. This lead, he will probably say, is used by several large concerns whose product we know is all that could be desired. Here is where the impractical man is led astray. He does not consider what quality of sand the parties referred to are using behind this lead. Perhaps this is a good open sand that would do the work nearly as well without any lead or facing. We try this lead on our work; our sand is close and contains matter which promotes the formation of gas, and this creates in the molten metal an uneasy motion while it is being poured and after the mold is filled before it solidifies. This action of the iron causes additional wear on the surface of the mold and the cheaper grade of blacking will wash and rise to the surface, thus producing a dirty casting.

Poor molding sand is a great drawback. I have in mind a firm that obtains a very poor grade of molding sand from a supply house some 20 miles away, when better sand could be dug within one mile of the shop. The only objection is, this good sand cannot be shipped in carload lots, but must be hauled by wagon loads, which is really preferable as it is an easy matter to reject the wagon load of poor sand and receive a better grade from the same wagon an hour later. But 'tis no small job to be compelled to work up three or four carloads of inferior material.

Poor coke causes much trouble. I know of a large concern in the West who use a very cheap grade of soft coke for melting because it can be purchased at about $3 per ton less than good seventy-two-hour coke would cost. They claim a saving in this method, but it is my belief that if they should consider the extra time consumed in melting and the castings that find their way to the scrap pile on account of dull iron, they would realize that there is more economy in using a good grade of coke.

The same is true where one blower is used to furnish wind for two cupolas, and the capacity of the blower is but a little more than is required for one cupola. This makes it necessary to put the blast on at, say, 12.40 or 1 o'clock, and with two cupolas, one 60 inches and one 48 inches diameter, it is a good job to melt 60 tons by 5 o'clock, which means 15 tons per hour for two cupolas. Now, if an independent blower were used for each cupola, with the proper tuyere location, the time consumed in melting could be cut nearly in half. This would make it possible for the molder to work up till 3 o'clock P. M. at molding, instead of beginning to pour off at 1 o'clock, which would mean two hours more. This would in a short time pay for several new blowers.

When we refuse to give our molders good flasks and good patterns to work with in order to save, we often lose more in bad work than it would take to build new patterns and flasks, to say nothing of the delays caused by failures of molders to make good work which may be directly traced to poor rigging. To those who have always considered the building of flasks an unnecessary expense, and have practiced the most rigid economy in regard to them, I want to say that good molders are hard to get and expensive. In shops where the proper appliances cannot be secured, they are hard to keep. But if we make the equipment of the foundry a personal study and build our flasks, patterns, etc., in a manner that will simplify the work regardless of first cost, the question of good molders will be settled. With all conditions as they should be and the work and methods made easy it is possible to develop good molders out of what men we have in our own shop or even out of men that have never handled a rammer or shovel. I would prefer the latter, as I believe there is much more economy in teaching a green man how to mold and paying him for scrap castings for a couple of weeks and later receiving a fair day's work from his floor the year round than there is in compelling a molder who has worked at the trade all his life to work in a different manner than he has been accustomed to.

The idea of economy with reference to patternmaking is in some cases a delusion. For instance, it is more expensive to give a large gang of men one locomotive cylinder pattern and have them ram and finish two or more a day than it would be to make two or more patterns and let them make one a day each. Two molders will accomplish more in a day than one half of what four men will accomplish on the same job with only one pattern. Besides this, much better work is the result of placing fewer men on the job. Hence, where we have a number of castings to make in a rush, it is cheaper to build an extra pattern than to crowd too many men on one pattern.

In making iron flasks for locomotive cylinders it is economy to make separate flasks for the different sizes, where there is any great variation. It is false economy to try to use one large flask for all sizes. The reason is plain enough. On the small ones the same amount of labor is required to ram it up as on a large one when one large flask is used. And in drying the mold double the amount of fuel and time is required, to say nothing of the danger of the large body of sand sagging and causing the mold to lose its proper shape.

There are many other things that could be mentioned which cause much waste, such as insufficient dry sand and core oven capacity, crooked core plates, improperly constructed patterns, system of handling melted iron, casting, sand, flasks, etc. The different items I have made mention of in the above are not new to foundrymen. Although we all realize that these things help to increase the costs of production, there are many foundries to-day where just such conditions prevail.

*At the Boston meeting of the American Foundrymens' Association.

Economy Due to Reheating Compressed Air.*

It was the object of the experimenters in these tests to ascertain the exact gain to be obtained from reheating compressed air when used in small motors.

A small 2 horse-power vertical engine with a shaft governor was used as the motor. The compressed air coming from the compressor was first passed through a meter, and then, before being admitted to the engine, was passed through a reheater. The arrangement of the apparatus is plainly illustrated in Fig. 1.

The amount of air used in each run was recorded by the meter, which was furnished for the test by the Equitable Meter Company, of Pittsburgh, and was especially designed to withstand high pressures. The air passed through the meter at the temperature of the atmosphere. The meter was calibrated for the pressures used in the experiments, before and after the runs were made, and the meter readings were corrected from this calibration. The results therefore show accurately the amount of air used in each case. The reheater was constructed of pipe. It consisted of a coil of three lengths of 1¼-inch wrought iron pipe, which was surrounded by an outer casing of 6-inch pipe, the casing being covered with an asbestos non-conducting covering, which prevented the escape of heat. The construction of the reheater is indicated in the diagram.

Gas was used as the fuel, and was burned in a burner placed at the base of the reheater. Gas was selected as the fuel on account of the ease with which the supply of heat could be governed. A gas meter recorded the amount of gas used in each run. The amount of heat supplied to the reheater is easily computed when the heat value per cubic foot and the number of cubic feet of gas supplied per hour are known.

*Tests performed by W. G. Edmondson and E. L. Walker, students in the Railway Engineering Department of Cornell University.

The engine was equipped with a prony brake, and an indicator was attached to the cylinder, which enabled both the D. H. P. and I. H. P. to be computed.

In every case the temperature of the air was taken at the meter, and again after it had passed through the reheater, at a point as near to its entrance to the engine as possible.

In conducting the experiments three series of runs were taken, as follows:

Series 1, in which six runs were taken, all at about 57 pounds gage pressure, while the temperature of the air entering the engine was varied from 60 to 401 degrees Fahr.

Series 2, in which five runs were taken, all at about 82 pounds gage pressure, while the temperature of the air entering the engine was varied from 60 to 395 degrees Fahr.

Series 3, in which two runs were taken at about 77 pounds gage pressure, the temperature of the entering air being 42 and 266 degrees Fahr. respectively.

The average results from each run were taken from the log of each run and are shown in the tables of general results.

The tests were performed during the month of April, 1902, in the mechanical laboratory of Sibley College, Cornell University.

The term "cubic feet of free air" is used to represent the volume of air at standard conditions, which are taken in this case to be at a pressure of 14.7 pounds absolute and at a temperature of 60 degrees Fahr.

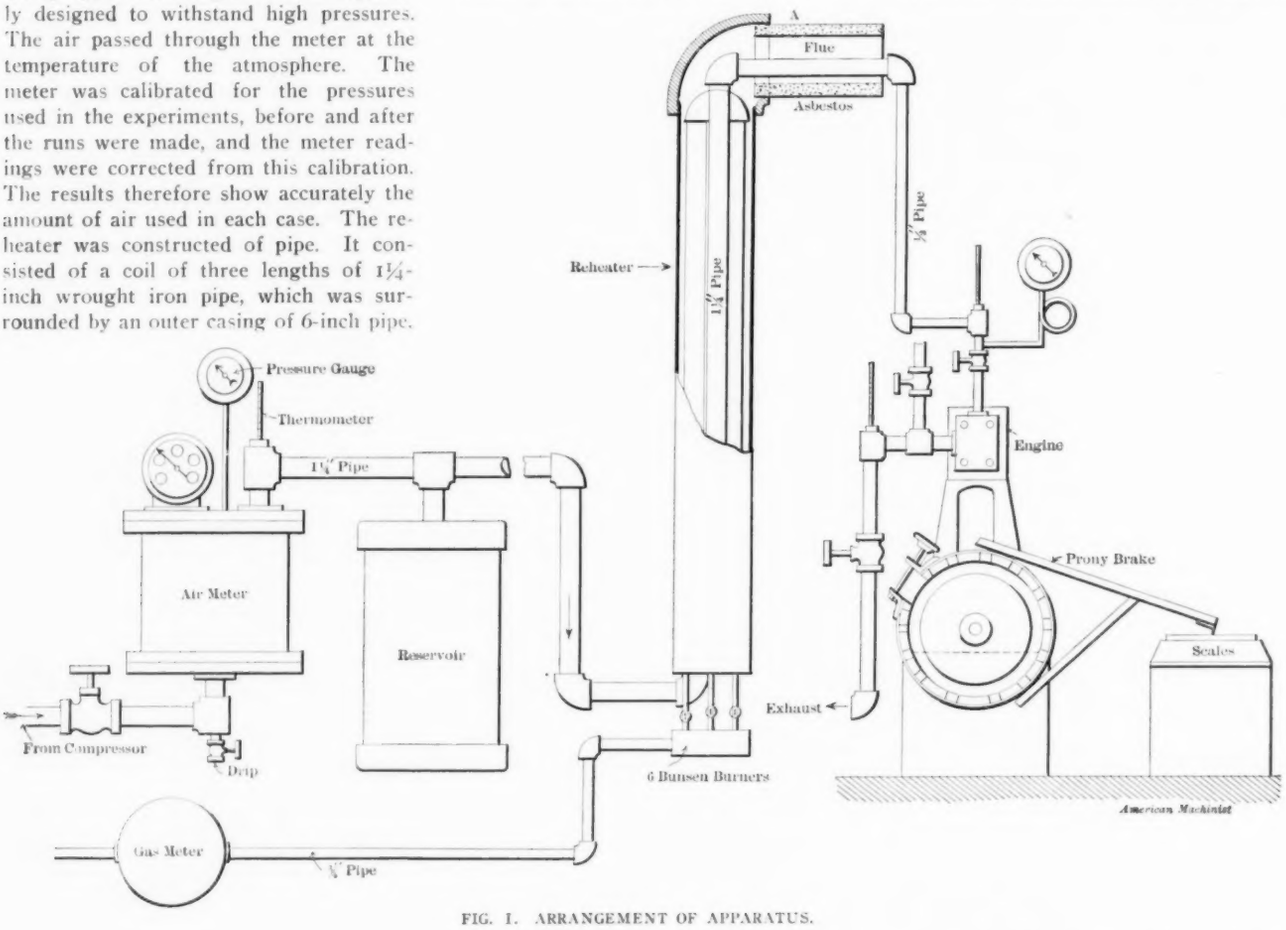


FIG. 1. ARRANGEMENT OF APPARATUS.

CONCLUSIONS.

The net gain in economy obtained with the lower pressure was 38.4 per cent., while with the higher pressure it was but 31.7 per cent. with the same conditions. In other words we get a reduction of from 31 to 38 per cent. in the cost of the production of compressed air by reheating the air from 60 degrees Fahr. to 400 degrees Fahr.

The curves of Fig. 2 illustrate the increase of economy with increase of temperature. It is seen that the increase in economy is gradually lessened after the temperature reaches about 300 degrees Fahr. By continuing the curve it would indicate that the point would soon be reached where an increase in the temperature would not cause any further increase in economy; this point being reached at about 450 degrees Fahr.

The results obtained in these experiments afford a very interesting comparison of the effects produced by different degrees of reheating, as well as by the use of different working pressures. Of the three different series of runs taken, the one employing the lowest pressure (56 pounds) seemed to give the most efficient results.

It was not considered advisable with our engine to raise the temperature of the entering air much above 400 degrees Fahr..

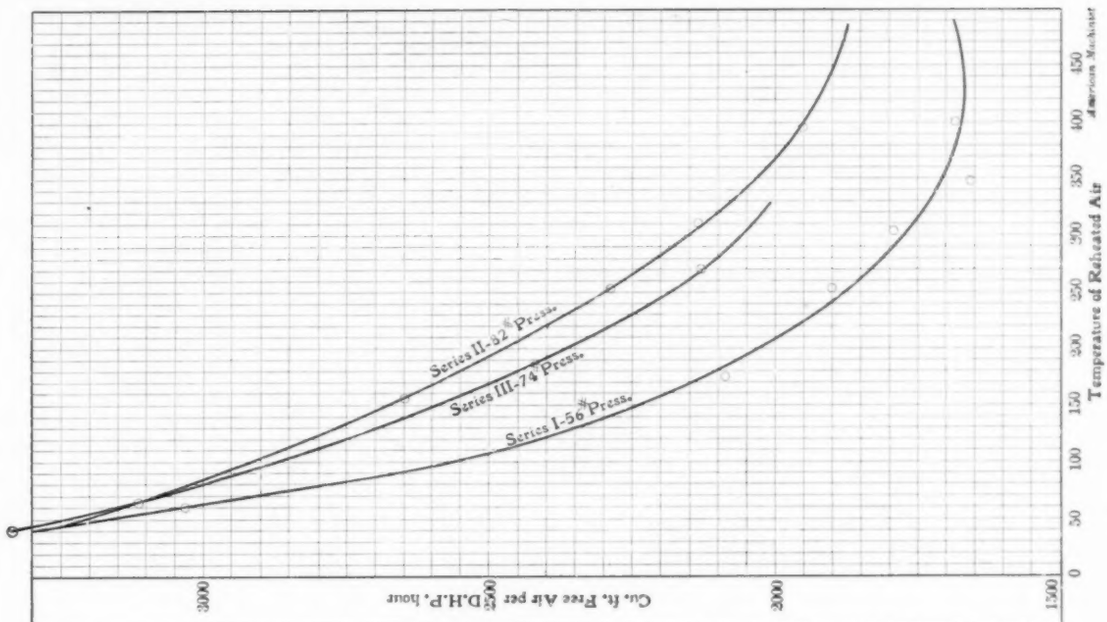


FIG. 4. REDUCED CONSUMPTION OF COMPRESSED AIR DUE TO REHEATING.

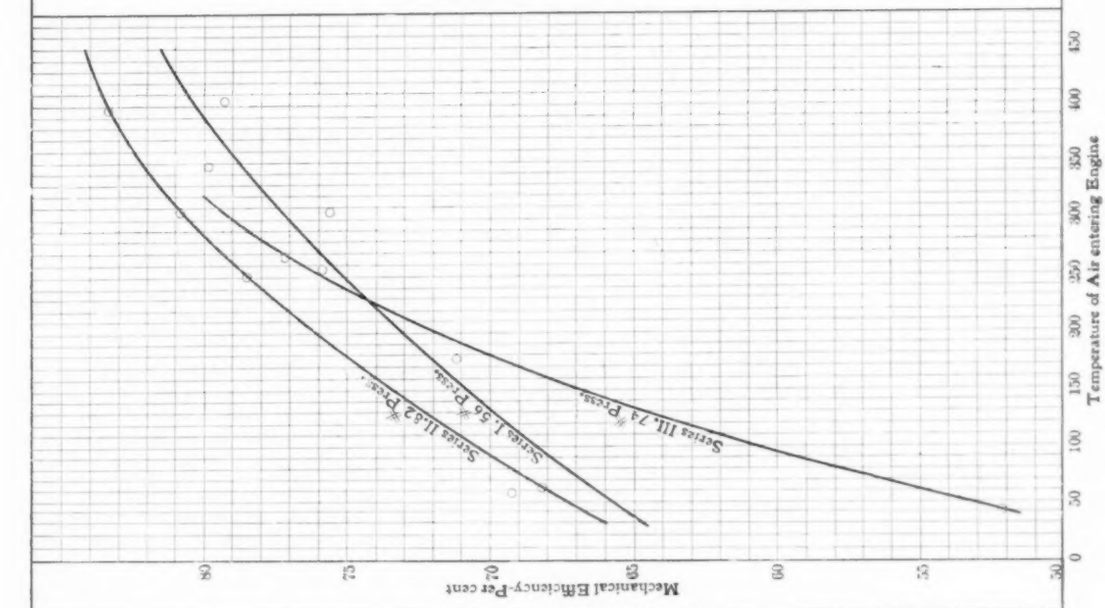


FIG. 3. INCREASED MECHANICAL EFFICIENCY DUE TO REHEATING.

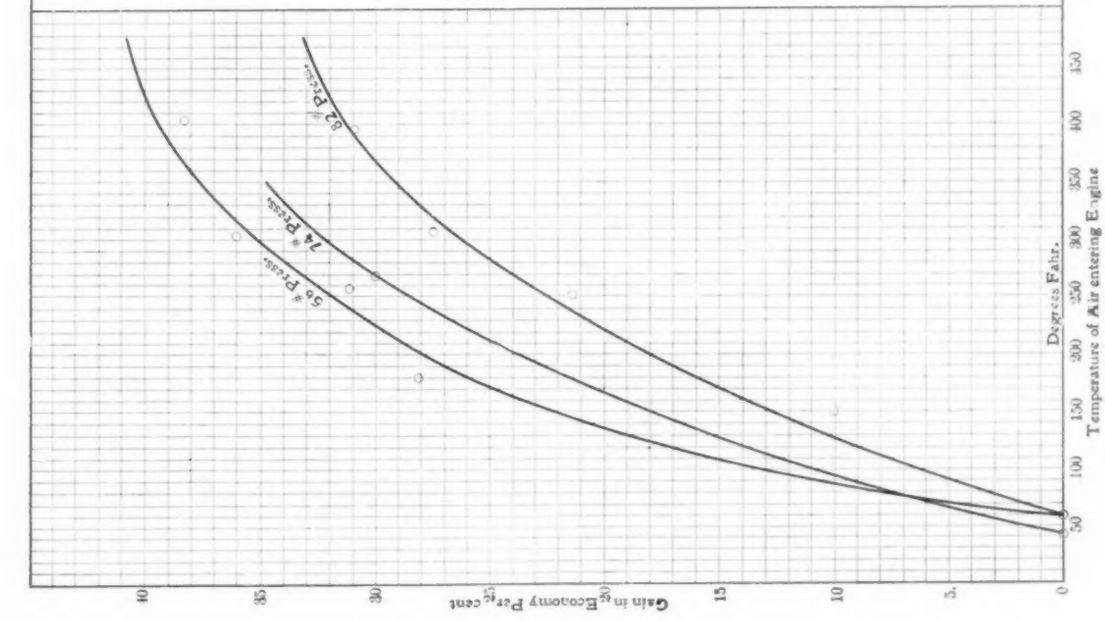


FIG. 2. INCREASED ECONOMY DUE TO REHEATING.

on account of the bad effect it would have on the packing of the valve and piston rods and also on the lubricant. However, a much higher temperature could have been attained with the reheater used.

Although the economy derived from the application of heat to the air may result from the increased volume, yet we are led to believe that the high results obtained are due partly to other changes of condition in the working of the engine resulting from the higher temperatures. By reheating the air the engine is relieved from the difficulties due to freezing of the moisture in the exhaust passages and the choking up of the valve.

It was noticed that as the temperature of the air was raised while the pressure remained constant, that the speed of the engine was increased, the cut-off was made shorter, and in general the operation of the engine became much more smooth.

The results obtained in these experiments may be represented clearly by means of a simple proportion. Referring to the results obtained in Series 1, we find that the maximum gain in air saved with the highest temperature is 44 per cent. of the amount of cold air required to produce the same amount of power.

Assuming that 100 pounds of compressed air at 60 pounds pressure are required to produce 1 horse-power per hour at 60 degrees Fahr., if this air be heated to 400 degrees Fahr., we effect a saving of 44 per cent., and we will then require but 100 — 44 = 56 pounds per horse-power hour. At this rate if we take 100 pounds of cold air and reheat it to the above temperature, the increase in the power produced will be:

$$56 : 100 :: 100 : x$$

That is $x = 178.6$

which indicates that the power derived from the same weight of air would be increased about 78 per cent. by reheating it from 60 degrees Fahr. to 400 degrees Fahr. In other words, a compressor which is able to supply 100 horse-power at the motor with cold air could be made to supply 178 horse-power by the use of reheaters.

As the increase in volume obtained by raising the temperature of the air this amount is only 65.3 per cent., it will be observed that the increased saving must be due partly to the more favorable conditions that the heated air provides for the engine to operate under.

The percentages of gain given in the results refer to the D. H. P., and the increased mechanical efficiency caused by the use of heated air must have a considerable effect upon the results. The increase in mechanical efficiency is shown by the curves of Fig. 3.

Three important points are secured by the use of a reheater, viz.:

1. Absence of freezing.
2. Reduced cost of plant throughout.
3. Increase in permanent economy.

REMARKS ON DATA.

In run No. 1, Series 1, the temperature of the air entering the engine was raised from 51 to 59 degrees Fahr. This was on account of the excessive accumulation of ice in the valve at the lower temperature, which interfered seriously with the smooth operation of the engine.

Run No. 5, Series 1, was made without measuring the quantity of gas used, as the gas meter was not in working order.

The results of the runs taken with cold air in each case, which are called run No. 1, did not include any of the calculations which come under the reheater system, and these spaces are therefore left blank.

In Series 3 the Sergeant cast-iron stove reheater was used and only two runs were made—one cold and one with hot air, as it was considered advisable to abandon this form of reheater after that. However, the two runs taken afford sufficient data for comparison. The efficiency of the reheater is assumed to be 50 per cent., in order that the results may be worked out on a basis similar to Series 1 and 2.

1	No. of run	1	2	3	4	5	6
2	Length of run, hours	1	1	1	1	1	1
3	Barometer	29.41	28.97	28.89	28.89	29.0	29.32
4	Gage press. at meter (corrected)	57.6	55	55.4	57.8	58.7	58.7
5	Gage press. at engine	55	53	53.8	56	57	57
6	Temp. at meter	51.2	86.8	86.3	79.1	81.5	74.3
7	Temp. at engine	59	176.5	256	306	348	401
8	Temp. of exhaust air	7	87.6	147	177	198	236
9	Temp. of room	48	79	83	78	76	70
10	Temp. of flue in heater	—	220	309	352	—	421
11	Cubic ft. of air per hour from meter	371	319.5	300	270	248.5	234
12	Cubic ft. of air per hour, corrected from calibration of meter	377	323.4	303.4	274.4	252.6	238
13	Cubic ft. of air per hour at standard conditions	1,877	1,445	1,367	1,295	1,204	1,150
14	Increase in temp. of air by heating	—	89.7	169.7	226.9	266.5	326.7
15	Corresponding increase in vol., per cent	—	16.4	31	42	49.4	61.1
16	Weight of air supplied per hour, lbs.	143.5	110.4	104.4	99	92.2	87.8
17	B.T.U.'s absorbed by air per hour	2,659	2,350	4,210	5,340	5,840	6,820
18	Cubic ft. of gas per hour from meter	—	9.5	16.5	22.2	—	28.8
19	Cubic ft. of gas per hour, actual	—	8.7	15.7	21.4	—	28
20	B.T.U.'s contained in 1 cubic ft. of gas	530	530	530	530	530	530
21	B.T.U.'s supplied to heater per hour	—	4,615	8,320	11,350	—	14,840
22	Efficiency of reheater	—	51	50.6	47.1	—	45.9
23	Av. cut-off, head and crank, per cent	56	36.5	35	32.2	29.4	28
24	Average ratio of expansion	1.79	2.74	2.86	3.11	3.40	3.57
25	Range of temp. of air in engine	52	88.9	109	129	150	165
26	Revolutions per minute	330.5	363	375	378.9	381.5	357.5
27	Brake load, lbs.	5	5	5	5	5	5
28	D. H. P.	.629	.693	.7175	.7235	.727	.682
29	I. H. P.	.909	.976	.945	.956	.910	.860
30	Mechanical efficiency, per cent.	69.2	71	75.9	75.6	79.9	79.3
31	Cubic ft. of free air used per D.H.P. hr.	3,030	2,085	1,901	1,790	1,658	1,688
32	Cubic ft. of free air used per I.H.P. hour	2,650	1,480	1,446	1,355	1,330	1,338
33	Cubic ft. of free air used per D. H. P. per minute	50.5	34.75	31.75	29.86	27.7	28.15
34	Pounds of air used per D. H. P. hour	228	159.3	145.5	137	127	128.9
35	Cubic ft. of free air saved per D.H.P.hr.	—	945	1,129	1,240	1,372	1,352
36	Gain in air saved, per cent.	0	31.2	37.25	40.9	45.25	44.6
37	Equivalent H. P. from heater per hour	0	.196	.258	.296	.329	.304
38	Percentage of power from heater	0	31.2	32.25	40.9	45.25	44.6
39	Heat equivalent of work done per hour (I. H. P.)	2,315	2,485	2,450	2,436	2,320	2,190
40	Work done per lb. of air, adiabatic expansion (n=1.408) . . B. T. U.'s	9,170	5,130	5,000	4,690	4,600	4,630
41	Efficiency of the fluid, per cent.	25.3	48.5	49	51.8	50.4	47.2
42	Thermal cost of air saved per D. H. P. hour, B. T. U.'s	—	6670	11,600	15,700	—	21,800
43	Thermal cost of equivalent amount of air from compressor, B. T. U.'s	—	131,500	15,700	172,500	191,500	188,500
44	Ratio: $\frac{\text{Cost of air by compressing}}{\text{Cost of air by heating}}$	—	19.7	13.5	11	—	8.62
45	Thermal cost of air from compressor in B. T. U.'s per D. H. P. hour	415,000	292,000	264,200	249,000	231,000	234,000
46	Total thermal cost of air used per D. H. P. hour	415,000	298,670	275,800	264,700	—	255,800
47	Gain in economy, per cent.	—	28.1	31.2	36.3	—	38.4

GENERAL RESULTS: SERIES I.

Standardization in Great Britain.

United States Consul Halstead, of Birmingham, does excellent service in calling attention to the following notable editorial in a recent issue of the London *Times*. It deals with the subject of the standardization of engineering and mechanical details in such a satisfactory way that although the ideas presented are none of them new to American readers, this concise statement of them will be welcome. In the consideration now being given to topics of this character would seem to be the greatest promise for the rehabilitation of British industries. The *Times* writer says:

"The favorable reception given by Mr. Balfour to the deputation which lately

waited upon him on the subject of engineering standards, as reported by us a day or two ago, and his announcement that both the War Office and the Admiralty were prepared heartily to co-operate with the efforts of the eminent committee which approached him on the subject, are full of promise for some of those departments of British industry which of late years have been most seriously threatened by foreign competition. Few people have any adequate conception of the waste of money, of time and of material which is consequent upon the employment of all manner of irregular shapes and sizes in various kinds of constructive work; and the evils hence arising—although attention was first called to them by an eminent Englishman more than sixty years ago—have been tolerated in this country with an indifference or supineness which has not been displayed elsewhere. It was in 1841 that the late Sir Joseph Whitworth pointed out the inconvenience constantly arising from the different patterns of screws then employed by different makers of machinery, with the result that a machine in some distant part of the world might be crippled for want of a single screw, and might remain so until sufficient time had been given to send to the workshop of the original maker for the supply of the deficiency. He proposed that manufacturers should agree upon a uniform size and pitch of thread for every diameter of screw or of aperture, and was promptly met by the contention that the standard screws were accepted he was at once in a position to supply the tools necessary for cutting them. His attention was soon after diverted to other subjects, but he constantly regretted his inability to deal with other things as he had dealt with screws, and was never weary of expatiating upon the advantages which would accrue to British industry from the national adoption of a sufficient variety of standard sizes in all departments of manufacture. His favorite object lesson was furnished by a candle wabbling loosely in a candlestick, and only rendered firm by a band of paper, or by one requiring to be scraped before it could be fixed; and he would ask why candlemakers should not agree as to the number of sizes required by consumers, and why every No. 1 British candle should not fit easily and correctly into every No. 1 British candlestick. The iron and timber parts of buildings, such as girders, doors, door frames, window sashes, and the like, moved him to wrath by their diversity; and he was accustomed to maintain that the convenience which would be afforded to purchasers by the general adoption of a proper number of English standards, and by accurate working to them, would be sufficient to give something like a monopoly of the trade in every branch of manufacture in which the principle was carried into effect.

1 No. of run	1	2	3	4	5
2 Length of run, hours	1	1	1	1	1
3 Barometer	29.4	29.28	29.24	29.38	29.34
4 Gage press. at meter (corrected)	79.6	81	82	82.5	82
5 Gage press. at engine	76.6	78	79	79.6	79.2
6 Temp. at meter	64	63	66	64.2	63
7 Temp. at engine	63	160.5	252.5	307.5	395
8 Temp. of exhaust air	9	81	146	192.4	248
9 Temp. of room	51	63	63	58	64
10 Temp. of flue in heater	—	213	299	360	425
11 Cubic ft. of air per hour from meter	315	293	252	237	214
12 Cubic ft. of air per hour, corrected from calibration of meter	331.5	308.5	266	252	226
13 Cubic ft. of air per hour at standard conditions	2,105	1,992	1,725	1,646	1,474
14 Increase in temp of air by heating	—	96.5	186.5	243.3	332
15 Corresponding increase in vol., per cent.	—	18.5	35.5	46.5	63.5
16 Weight of air supplied per hour, lbs	161	152.2	132	125.7	112.8
17 B. T. U.'s absorbed by air per hour	—	3,490	5,840	7,250	8,870
18 Cubic ft. of gas per hour from meter	—	13.5	19.4	22	33.6
19 Cubic ft. of gas per hour, actual	—	12.7	18.6	21.2	32.8
20 B. T. U.'s contained in 1 cubic ft. of gas	—	530	530	530	530
21 B. T. U.'s supplied to heater per hour	—	6,730	9,850	11,220	17,380
22 Efficiency of reheater, per cent.	—	51.8	59.3	64.6	57.1
23 Average cut-off, head and crank, per cent	30	26.2	20.2	18.5	17.4
24 Average ratio of expansion	3.33	3.82	4.95	5.4	5.75
25 Range of temp. of air in engine	54	79.5	106.5	115.7	147
26 Revolutions per minute	360	395.3	396	403.3	396
27 Brake load (net), lbs.	5	5	5	5	5
28 D. H. P.	.685	.753	.755	.770	.755
29 I. H. P.	.999	1.11	1.027	.953	.903
30 Mechanical efficiency, per cent.	68.5	67.9	78.6	.808	.835
31 Cubic ft. of free air used per D. H. P. hour	3,120	2,650	2,286	2,137	1,951
32 Cubic ft. of free air used per I. H. P. hour	2,110	1,800	1,682	1,725	1,632
33 Cubic ft. of free air used per D.H.P. per minute	52	44.16	38.1	35.6	32.5
34 Pounds of air used per D. H. P. per hour	235	202	175	163.2	149
35 Cubic ft. of free air saved per D. H. P. hour (from 60° F.)	10	480	844	993	1,179
36 Gain in air saved, per cent.	—	15.35	27	31.7	37.7
37 Equivalent H. P. from heater per hour	—	.1158	.204	.244	.285
38 Percentage of power from heater	—	15.35	27	31.7	37.7
39 Heat equivalent of work done per hr. (I.H.P.)	2,544	2,825	2,616	2,430	2,300
40 Work done per hour by air, adiabatic expansion ($n = 1.408$) B. T. U.'s	8,200	7,760	6,720	6,420	5,750
41 Efficiency of fluid	31	36.4	39	38.8	40
42 Thermal cost of air saved per D. H. P. hour, B. T. U.'s	—	8,930	13,050	14,600	23,000
43 Thermal cost of equivalent amount of air from compression	—	73,100	129,000	152,000	180,000
44 Ratio: $\frac{\text{Cost of air by compressing}}{\text{Cost of air by heating}}$	—	8.2	9.88	10.4	7.84
45 Thermal cost of air from compressor in B. T. U.'s per D. H. P. hour	470,000	404,000	350,000	326,400	298,000
46 Total thermal cost of air used per D.H.P. hour	470,000	412,930	363,050	341,000	321,000
47 Gain in economy, per cent.	—	10	22.7	27.5	31.7

GENERAL RESULTS: SERIES II.

"Perhaps, the first important step toward action upon Whitworth's principles was taken some years ago by an association representing the principal railroads of America, which had for one of its objects the attainment of uniformity in the patterns of rails and in the parts of locomotives. This association set itself to determine, for example, how many patterns of locomotive were required for the various demands for traffic—for express engines, goods engines, shunting engines, and so forth—and how these might be made in the most economical and practical way. The result was, certain patterns having been adopted by all the companies included in the association, that manufacturers were able to work for stock at times when they had no orders in hand, and to do this without danger of finding themselves burdened with unsalable goods. An incidental consequence was, of course, comparative cheapness of manufacture, and that in a degree which speedily made itself felt when railways outside America were coming into the market as purchasers, and were content to deny themselves the luxury of engines which had been 'specially designed' by their own officials. Mr. Balfour told the deputation not only that 'the advantages of standardization were obvious,' but also 'that no human being could have a doubt as to the magnitude and the importance of the subject,' and that, as far as he could offer an opinion, he entirely agreed with the views placed before him by the members of the

form used in every workshop was, in some point or other, better than the rest. Firm A would not use the screws used by firm B, and firm C would have nothing to do with those of either. But the shrewd and patient north countryman was not easily discouraged. He evaded the difficulty by producing the exact mean of the several patterns used by the most eminent firms, and his proposal was adopted by acclamation. He had so far foreseen this result as to have quietly prepared machinery for dealing with it, and when the

deputation. These are strong expressions, and the majority of people will think them entirely justified by facts; but it is nevertheless true that these same views have been urged by a few persons for a great number of years, and that so far they do not appear to have met with a degree of acceptance at all commensurate either with their truth or with their importance. The case has too often been like that of the diversity of screws, but with no Whitworth to suggest the happy mean by which individual claims or pretensions could be reconciled. Every designer has been wishful to have 'his own' pattern of some appliance in general, or perhaps universal, demand—a pattern a little thicker or a little thinner than that usually employed, and perhaps only representing a maximum of cost in combination with a minimum of advantage.

"A variety of circumstances, however, have lately combined to force the question of standardization upon British engineers and mechanicians, foremost among them being the recent discussion as to the supply of locomotives to Indian railways and the enormous demand which has lately arisen for various kinds of electrical machinery. The merit of perceiving and of acting upon the favorable opportunity is largely attributable to Sir John Wolfe-Barry, whose plea for reform has been taken up by the Institution of Civil Engineers, with the co-operation of the Institution of Mechanical Engineers, the Institution of Naval Architects, and the Iron and Steel Institute, and has led to the formation of a very strong committee, comprising many of the most eminent names among the leading members of these bodies, with a recent addition of representatives from the Institution of Electrical Engineers. It follows that the movement is now being backed by all the leading technical societies of the country, and is being controlled by practical men who are in touch with the requirements of the engineering professions and trades. It may therefore be reasonably expected to be marked by a sufficient flexibility of adaptation to altered circumstances, so that the opposite errors of too great readiness to discard the old and of too great reluctance to adopt the new may both be effectually guarded against. It would be quite possible, of course, to erect an undue worship of standardization into a barrier against improvement, or against the adoption of modifications which the real needs of actual or potential customers might require; but any such danger appears to be much diminished by the lines on which the committee and its sub-committees have been constituted. It is a matter for great congratulation that the principal manufacturing or purchasing departments of the government should be brought into touch with the movement, so that these departments when placing their contracts may recognize the standards laid down by the committees. There is much reason to believe that the War Office and the Admiralty have in past times done a good deal to hinder the progess of manufacture by an obstinate adherence to methods or to demands which might with advantage have been suffered to become obsolete, and which would have been greatly modified in dealing with any private consumer. The more completely the spending departments can be brought into touch with ordinary requirements the better it will be alike for the manufacturer and for the taxpayer; and the more hearty the co-operation of the goverment with the movement which has elicited from Mr. Balfour expressions of cordial approval the more rapidly will the pessimists among us be relieved of the anxiety concerning foreign competition which they have lately had some ground both for feeling and for expressing. The British Empire has conducted a great war to a triumphant issue, and its sons must now gird themselves for equal efforts in the competitions of peace."

1	No. of run	1	2
2	Press. at meter	76	78
3	Press. at engine	73	75
4	Temp. at meter	44	67
5	Temp. at engine	42	266
6	Temp. of exhaust air	—	149.5
7	Temp. of room	42	65
8	Temp. in flue of heater	—	—
9	Cubic ft. of air per hour from meter	367	249
10	Cubic ft. of air per hour, corrected from calibration of meter	383	259
11	Cubic ft. of air per hour at standard conditions	2,430	1,606
12	Increase in temp. of air by heating	0	199
13	Corresponding increase in vol , per cent	0	38
14	Weight of air supplied per hour, lbs	185.6	122.7
15	B. T. U.'s absorbed by air per hour (from 67°)	—	5,790
16	B. T. U.'s required to raise temp. from 42° F	—	6,500
17	Total thermal cost of air used per hour, B. T. U.'s	352,500	246,000
18	B. T. U.'s supplied to heater per hour (from 42°)	—	13,000
19	Efficiency of reheater (assumed), per cent.	—	50
20	Revolutions per minute	392	396
21	Brake load	5	5
22	D. H. P.	.73	.755
23	I. H. P.	1.40	.974
24	Mechanical efficiency, per cent.	52.1	77.5
25	Cubic ft. of free air per D. H. P. hour	3,330	2,130
26	Cubic ft. of free air per I. H. P. hour	1,735	1,700
27	Cubic ft. of free air saved per D. H. P. hour	—	1,200
28	Gain in air saved, per cent.	—	36.4
29	Thermal cost of air saved per D. H. P. hour, B. T. U.'s	—	13,000
30	Thermal cost of equivalent amount of air from compressor, B. T. U.'s	—	174,600
31	Ratio: $\frac{\text{Cost of air by compressing}}{\text{Cost of air by heating}}$	—	13.4
32	Gain in economy, per cent.	—	30.2

GENERAL RESULTS: SERIES III.

The Foreman.

BY E. R. MARKHAM.

It is amusing to note the various ideas people have as to what constitutes the duties and privileges of a foreman in a machine shop. His duties depend, as a rule, on the instructions he receives from the men over him, and in many cases it depends on his capabilities as to how much discretionary power is given him. A man's disposition and natural tendencies do not, as a rule, change when he is given authority; they simply are accentuated. A nervous man becomes more nervous, and in time irritable as his responsibilities increase. Men under him should take this into consideration. A mean man's meanness increases as he is given opportunity to wreak his venom on those he doesn't like. A timid man is afraid of the men above him, especially if their demeanor is such as to inspire men with that feeling; consequently, he is uneasy all the time and makes everyone around him uneasy.

In some shops a competent foreman is given almost absolute authority; he hires whom he pleases and discharges at will. In other shops a foreman cannot hire or discharge men; he is obliged to take what is sent him, and can only recommend the discharge of men whom he thinks incapable of doing the work. Some men are not capable of hiring men. They would hire relatives, members of their society or friends, regardless of the interests of the concern. In some shops a foreman is allowed his say as to what machinery and small tools he needs to do his work. In other shops someone plans all this for him and he is supposed to devote his entire time and energy to seeing that everything is done to rule and gage in a stated time, or within a given limit of cost. Some men holding the position of foremen are not capable of planning work, cannot systematically arrange detail, cannot tell how much a piece of work should cost to make, yet they can carry out orders to the letter. Such men should not have a voice in regard to equipment or methods of doing work. They cannot plan, but are satisfactory in execu-

tion. Such men are valuable in their places, and nuisances when out of them.

Some men have a personality which inspires confidence. If such men have the necessary knowledge and capabilities, they generally enjoy many privileges that are not shared by men who cannot inspire such confidence in people with whom they come in contact. In some shops the manager or superintendent would not think of making a move in any matter that pertained to the shop without consulting the foreman of the department affected by the move, because he knows that the foreman's judgment is to be relied on.

A manager or superintendent with a large-sized opinion of his own capabilities —when he hasn't any—who has got his position, and is holding it, through relationship or friendship with the powers that be or through bluff, who will not listen to reason from men knowing much more than himself, such a one can make a foreman's life about as miserable as can be imagined. A large man, or a man capable of filling a large position, is out of place in a shop where he simply executes the orders of men not as capable as himself. I have known men occupying such positions who were competent to design labor-saving tools, who could work so as to decrease the cost of product, who understood the proper methods to carry on the work in a systematic manner, yet who could not do these things, because they were under cast-iron orders to do so and so according to the whims of a man over them who knew his own capabilities and was fearful the manager might become acquainted with them, knowing full well what the consequences would be. Such a foreman is in about the same fix as a man with a No. 16 neck trying to wear a No. 14 collar—it is mighty galling.

One of the biggest mistakes is to give a man the position because he is the best workman in the department or shop. Many times the concern by so doing loses its best workman and gets a mighty poor foreman. Some of the best workmen I have ever seen have not been capable of handling men to advantage. They have known how to do a piece of work, but have not known how to get another man to do it to advantage.

Men are sometimes given a foremanship because they are hustlers. Now, a foreman who is a hustler and has a good balance wheel is a valuable man; but a hustler who is only a hustler, can kick up a good deal of trouble in a short space of time, if he goes ahead, not knowing whether he is right or wrong, because he can spoil such a quantity of work.

The qualifications necessary to constitute a successful foreman depend a great deal on the nature of the position. No one man would be successful everywhere, because the conditions are so different and the duties so varied. A concern about to hire a man for this position should study the man and see if he will fit the place. A man considering the position should study the place and see if it fits him and determine whether he can fill it.

Letters From Practical Men.

Boring Valve Seats and Guides in Line—Straightening by Heating.

Editor American Machinist:

We have lately been fitting up some hydraulic valves for riveters and hoists. In Fig. 1, *A* and *B* are nuts, *C* is the valve stem and *D* the valve seat. The boring for the nuts and seat was done on the lathe, and since the casting had to be reversed after boring and chasing for *A*, to bore for *B* and to face the valve seat,

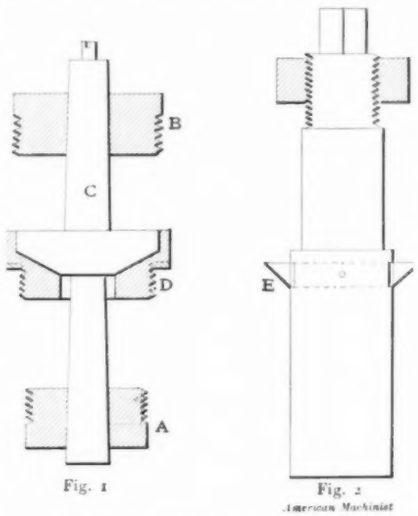


Fig. 1 Fig. 2

TOOL FOR TRUING A VALVE SEAT.

it often happened that the holes in nuts and face of valve seat were not in line. This we sometimes corrected by scraping the seat, a difficult job because of its place down in the center of the valve, and then again sometimes we would grind with emery, but that made a rough job.

The "Old Man" was finally persuaded to have a cutter made like Fig. 2, and that saved as much as two hours on a single stem. *E* is a double-ended cutter held in a slot by a cross-pin. I think a rose bit form of cutter would have been better, but not so easy to make.

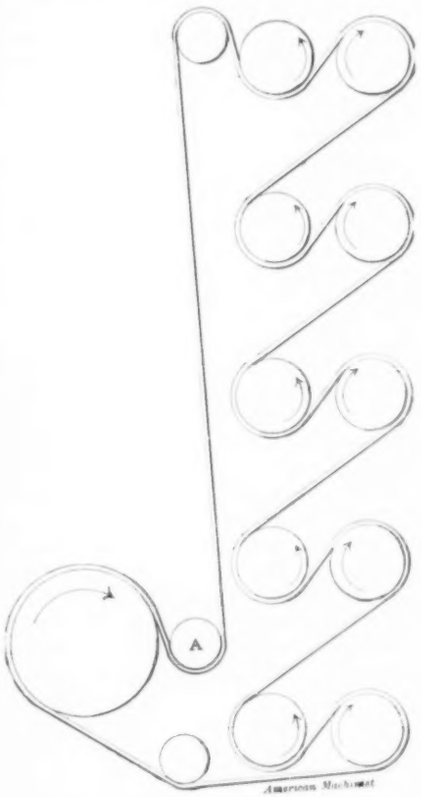
At page 880, A. Pidgen tells about straightening a shaft by heating and pouring water on the concave side, as he says to compress the metal on the convex side. Now, it looks to me as if cooling that side would merely make the shaft more crooked for the time, unless the ends and center were held rigidly, and that when it became uniform in temperature the same old twist would be there. CHEROOT.

An American Machinist Subscription as an Investment.

Editor American Machinist:

The mechanic or engineer in this day that doesn't read of what others are doing in his line of work had better "go way back and sit down." While not every issue contains something that can be applied to some case at hand, one often finds something that does fit. "Old Bob's" article on screw propellers furnished information to men that hadn't done a job of this kind before, and it was applied to such good purpose that the job was completed in excellent time at a good profit. "Shortway's" sawing of bevel gears has been applied and been worth dollars to me. "Old Bob's" sawing of screw threads has been found equally profitable.

In a recent issue there was illustrated a belt drive showing how a large number of spindles were driven with two belts. Some time ago I designed a machine having five pairs of feed rolls, as shown by the sketch. These were driven by a shaft running the length of the machine on which were five bevel pinions meshing into five bevel gears, one on each feed roll shaft. This would drive all the rolls on one side and each opposite roll was driven from its mate by a pair of spur gears. This made a total of twenty gears to drive the ten rolls. The makers wanted



A BELT SUBSTITUTED FOR TWENTY GEARS.

to reduce the cost of the machine to be better able to meet competition. Being asked if there wasn't some way to drive the feed rolls without all those gears, the above-mentioned belt drive occurred to me. It worked out nicely, as you will see by the sketch. For the spur gears on the roll shafts we substituted pulleys and eliminated also all the bevel gears, main shaft and bearings, and the springs that held the rolls

together, the belt now serving that purpose. Three idlers were added as well as the main driving pulley and idler *A* being adjustable to take up the slack in the belt. The pulleys, being turned in a turret lathe, reduced the cost greatly, and we had a smooth running machine. This application netted me the price of a good many years' subscription, so I think my $4 per well invested. J. L. GARD.

Blueprint Case.

Editor American Machinist:

From time to time descriptions of blueprint filing cases have appeared in the AMERICAN MACHINIST, and I enclose blueprints of a case which I wish to add to this list.

This case, as I designed it, was made to fill three requirements—first, a given wall space; second, fixed sizes of prints, and last, handiness. The last is the only point I wish to call your attention to.

Drawers are done away with, except for the index cards and miscellaneous large drawings which we wish to roll. The doors, as shown in Fig. 1, are hinged at the bottom, with flush ring catches, and when opened, a door will drop down against the one below, out of the way. Each compartment is provided with a galvanized iron slide, as shown in the isometric sketch, Fig. 2. The slide has a galvanized iron lid which raises and lowers as the prints are added or removed. This always keeps the prints down smooth.

The prints are separated by hundreds by sheets of stiff wrapping paper, which are properly indexed on the front edge. In filing drawings of machine tools, buildings, etc., no record is made on the index cards, but the name of each machine is printed on the lower left-hand side of the back of the print and they are filed in groups, such as lathes, planers, milling machines, etc. The groups are separated by the papers properly labeled.

When a drawing of a 28-inch lathe, for example, is wanted, it is not necessary to go to the index drawer and run over the cards to find the number of the drawing, but only to go to the machine tool slide and under "Lathes" it can be had with but little trouble.

It is as easy to get the bottom drawing out of the slide as the top, as one slips in or out as easily as the other. M. M.

[Our correspondent is a railroad master mechanic, and the filing system was adapted to his needs. The case has some good features, but the partition pieces between the trays could have been omitted by methods which have been shown in our columns. In this way $6 \times \frac{3}{4} = 4\frac{1}{2}$ inches of vertical space would have been saved, which is practically enough for another row of trays. We also prefer much shallower trays. We consider 2 inches as amply deep enough for this purpose, and would not quarrel with 1½ inches.—Ed.]

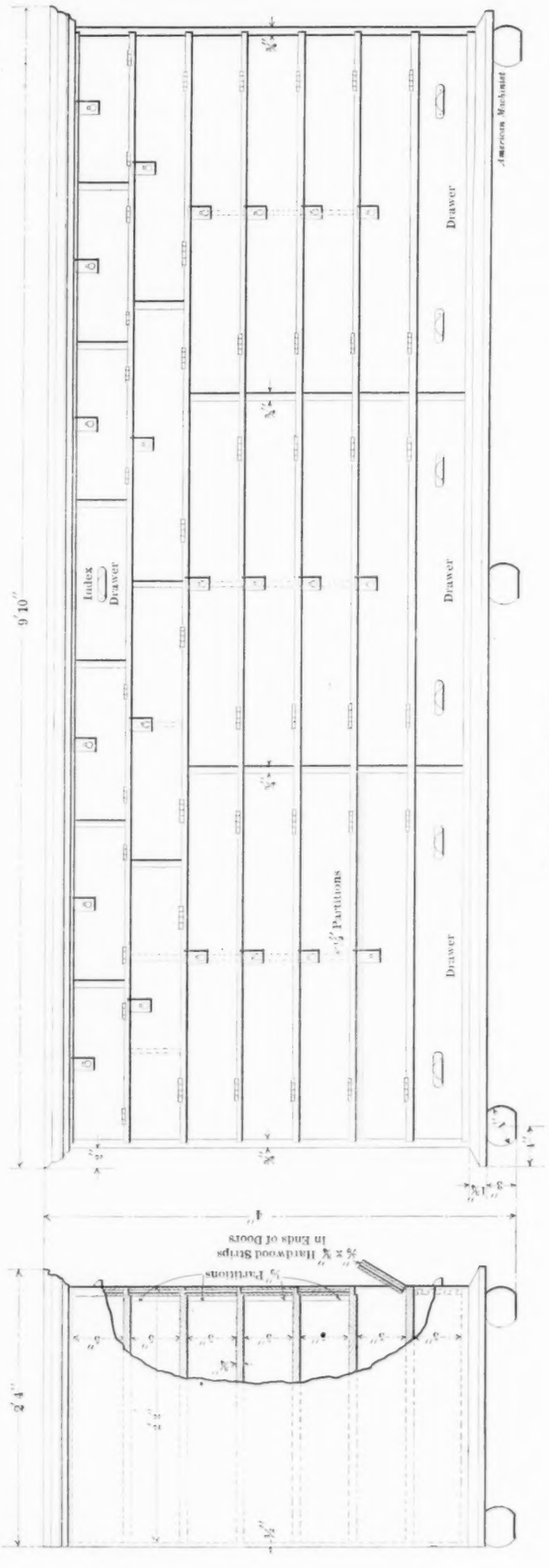


FIG. 1. BLUEPRINT CASE.

Trouble with Inspection and Japanning.

Editor American Machinist:

I would like to get the experience of others in regard to inspection of work. I am connected with the —— —— Company, Pittsburgh. We recently introduced an inspection department, and it has been the cause of a good deal of friction. The inspectors call for work which the foremen do not think necessary, and reject work which they think satisfactory.

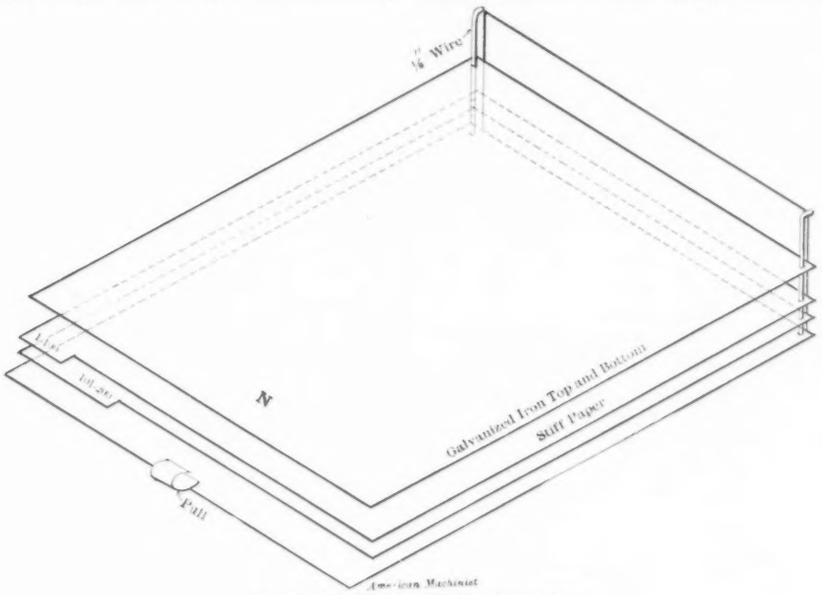


FIG. 2. TRAY FOR BLUEPRINT CASE.

Our work is small work, mostly stampings, the principal part being the assembling, but some of it calls for much mechanical skill. I should very much like to have the experience and systems adopted by others. I have recently placed it under the control of a head inspector. Before, each department had its own inspectors, and when the work was passed by one it was thrown out by the next; which ended in its being brought to me to decide on, causing me a good deal of bother. It is a little better now than formerly, the head inspector being appealed to for decisions; but still I think it could be improved.

I should also like to get a few pointers on japan work. We are using both baking and air drying, applied with soft brush or sprayer. It is either sticky or, if baked more, too brittle. I have thought of trying a filler, but wish to do without that expense. It is applied on small iron castings. INQUIRER.

How to Brace Up a Shop.

Editor American Machinist:

I will venture to give "Dutch," at page 1022, at least one reply. Life is short, and we cannot expect to make men over. They come to us ready made up to their own standard of workmanship; if they are careless and untidy, they will be so still, so that constant watchfulness on the part of their superiors is necessary to hold them above their natural plane. At the same time there is much in the adage "like master, like man."

If a workman's first sight of the shop office impresses him with its appearance of cleanliness, order and system, his inference is that the shop is being run on the same plan, and he mentally concludes that if he is to be an inmate he must strive to maintain, so far as his duties permit, a similar condition around him; but order and system are to some people matters of constant study and effort. I know of some workmen who would never lay tools on their benches except in the exact places they have previously provided for them, and others who could not find a tool if it was in its right place! A wife of one of the latter may arrange his shirts, collars, cuffs and neckties nicely in his dresser, and when he discovers it his ejaculation will be "how in the world am I to find anything?"

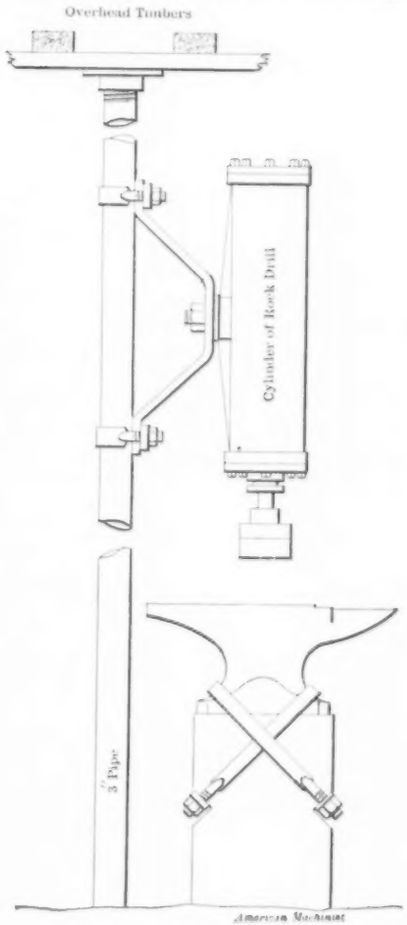
Now, order is something which can be enforced. Surely the foreman should have it inherently, naturally; he is not fit for his position without it. Order is objective and comprehends cleanliness as subjective. The orderly man is always neat; he picks up a paper, pin or thread which is out of place with scarcely a thought of the act; his sense of the "eternal fitness of things" is acute.

"Dutch" suggests "discharge" as a penalty for infraction of this "Heaven's first law," but sometimes it is more of a punishment to the employer than to the employed. Probably the *dernier ressort* must be discharge, but does the "punishment fit the crime"? I think not, except in extreme cases. The machine shop is a dirty place at best, and why should the man who is grimed with cast-iron dust and oil one-third of his life care if other things are? He partakes of the nature of his surroundings, and here is just where the question resolves itself. How much is the employer willing to pay for what he wants? That determined, the rest is easy, and the degree of cleanliness (I use cleanliness, order and system synonymously) that he gets will be in exact ratio to the cost. If he hires a man to work all the time, his first thought is his work. If he hires him to be orderly first, his work to be secondary, he will get as much of the former as the man's conception affords, although the chances are that he has made more of a study of his work than of anything else; so again we come to this, that the competent foreman is orderly and systematic. He is to understand that order, system and cleanliness are expected and required, and just so far as he is so, the shop will partake. If in this, as in other things, his men do not obey him, then comes the discharge, but the discharge is not for untidiness, it is for disobedience of orders, hence the simple solution of "Dutch's" conundrum. Give your orders, and then see that they are executed. EX-EMPLOYER.

A Rock Drill Used as a Steam Hammer.

Editor American Machinist:

Last summer I had the pleasure of an excursion to Colorado, and while there



A ROCK DRILL ARRANGED AS A STEAM HAMMER.

visited one of the gold mines, the Elkton, which is one of very numerous mines in the vicinity of Cripple Creek. At this mine I was interested in the ingenious

way in which a rock drill had been rigged up to take the place of one or two blacksmith helpers in the blacksmith's shop. The drill, minus the tripod, was fastened to a vertical support about as shown in the sketch, which was drawn from memory, no attempt being made to show an exact picture, but merely enough to convey an idea of the arrangement. An ordinary anvil was fixed in a position under the ram, and the necessary air connections, not shown, were made with the cylinder. When a blacksmith has some heavy hammering to do, he has someone, as usual, to manage this contrivance, while the smith takes care to have the blows struck in the proper places, as with a steam hammer, except that the blows are not as heavy, but a sight more numerous for a given space of time. At the time that I saw this improvised steam (?) hammer in operation, the blacksmith was working down a piece of steel or wrought iron, about 3 inches wide at its widest part, 1 inch thick at its thickest part, 2½ feet long, tapering in both width and thickness, and the hammer appeared to be doing excellent service. It appeared to me as a very simple, effective and quite inexpensive apparatus, especially considering the fact that it, excepting the hammer head, was rigged up from material to be found in any mining outfit, that it is easily moved into the mountain regions wherever the precious yellow metal exists, and that if at any time it be thought convenient to discontinue the use of this rig as a "steam" hammer, it could be very easily resolved into its original parts and their former duties resumed, since neither drill nor anvil suffers any from this somewhat unusual use.

W. A. Zee.

Automatic Wire-Bending Machine.

Editor American Machinist:

The machine here shown is for making small articles, such as *A*, directly from a coil of wire. The machine automatically feeds in and cuts off a length of wire, makes the bends and drops the finished piece into a box.

The frame of the machine is an angle iron, the base-plate being bolted to a bench or stand. The upright has a long hub *B*, and at the opposite end of the base-plate and also in the upright are bearings for the cam shaft.

The wire feed of the machine is worked by cam *C*, which moves lever *D*, the lever being held against the cam by the spring *E*. Lever *F* on the outer end of the lever shaft reciprocates the slide *G*. This slide carries a bushing through which passes the wire from the coil. At the forward end of the slide is screwed a spring clip which allows the wire to have forward motion but no backward motion.

To the right of the slide *G* is fastened a block *H* having a bushing and another spring clip, which prevents the wire from slipping back after it has once passed through the block.

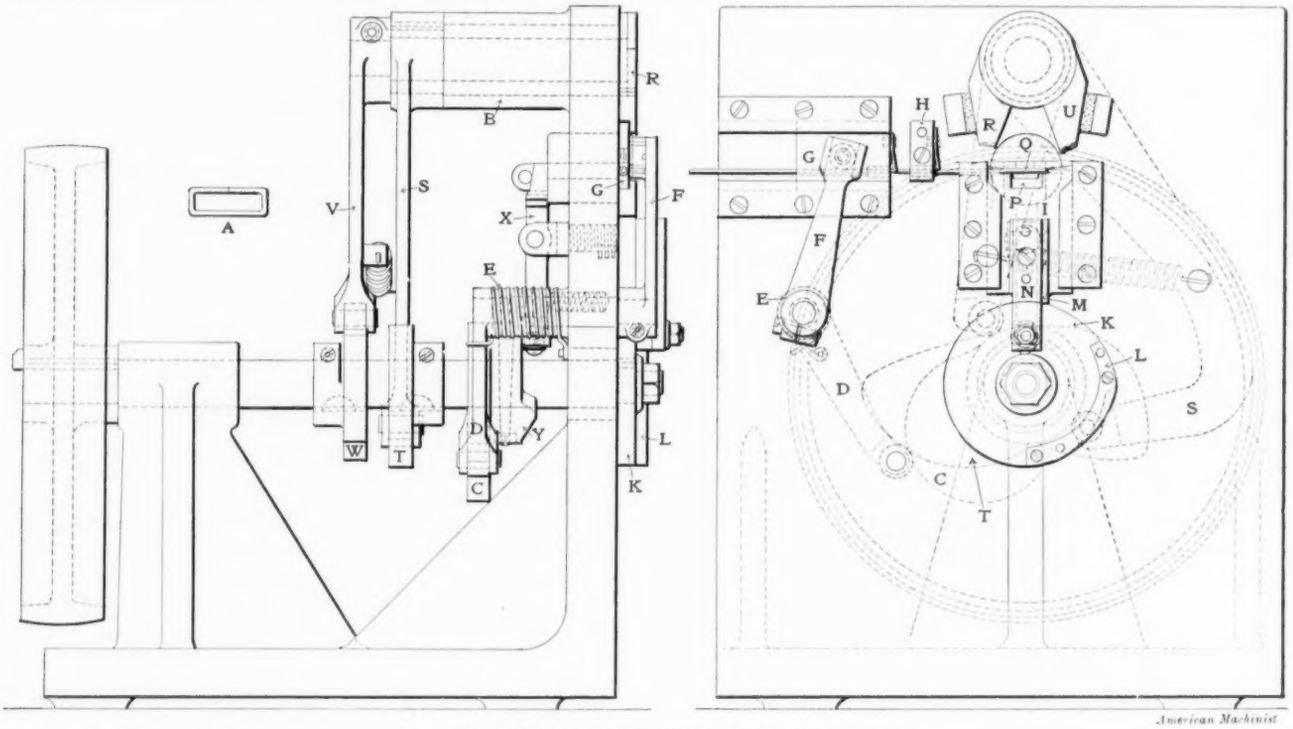
On the face of the upright, above the cam shaft, vertically reciprocates a block *I*. The left-hand guide for this block has a hole with a hardened steel bushing for the wire to pass through, the forward end being ground with a sharp, square corner on it where the wire emerges. On the block *I* is screwed a hardened steel knife, which shears off a length of wire for each rise of the block. The block *I* is reciprocated by means of the plate *K* fastened on the end of the cam shaft, and the cam segment *L*, of hardened tool steel, fastened by screws on to the plate *K*.

The block *I* also is tool steel, and has a hardened projection *M* that bears normally on the periphery of the plate *K*, but also bears on the cam segment *L* when this comes to the upper part of its travel. Screwed on to block *I* is a bar *N* carrying a cam roll, which causes the downward movement of the block.

At the upper end of the block is a slot *P* which is grooved on its vertical sides to fit the size of wire used. The top of the block also is grooved at each side and prevents the wire from slipping off.

Suppose that the wire is started into the machine as far as the forward end of the bushing in the upright guide. As the cam shaft turns, the slide *G* moves, bringing along the wire, then the block *I* rises and a length of wire is first cut off, but at the next instant it is caught against the oblong projection *Q*, and the ends are bent upward into a U-shape.

At the top of the angle iron frame is the before mentioned long hub *B*, in which is fitted a rocking sleeve, and inside of this sleeve a rocking shaft. At the outer end of the sleeve is an arm *R* integral with it and having its lower end grooved to fit the wire. At the inner end of the sleeve is keyed a forked lever *S* having a cam roll which bears on the cam *T*. Integral with the shaft within the sleeve is an arm *U* similar to *R*, but on the opposite hand, with its end grooved also to fit the wire. On the inner end of the shaft is a lever *V* with a cam roll bearing against the cam *W*. The ends of the two arms serve by their movement to bend the wire from the U-form into a complete link. Their return movement is accomplished by the



AUTOMATIC WIRE-BENDING MACHINE.

pull of the spring connecting the cam levers, the bending arms stopping against rubber cushions.

The projection *Q* around which the link is formed is the end of a short bar reciprocating horizontally in an oblong hole in a bushing driven into the frame.

The bar *Q* is reciprocated by a lever *X* pivoted in a forked stud screwed into the frame and locked by a tangent screw.

The upper end of the lever is forked, and works against a shoulder formed in the bar *Q* and a pin driven into its end. The lower end carries a cam roll which bears against a face cam *Y* pinned on to the cam shaft and forming the hub of the cam *C*. A spring operates the lever on its return movement.

Following is a complete cycle of operations: The sliding block *G* being at the beginning of its stroke, moves to the right, actuated by the mechanisms already described, carrying with it the wire from the coil, held by means of the spring clip. The block *I* now rises, cuts off a length of wire, and, forcing it against the projection of the bar *Q*, bends the two ends upward, holding it there an instant until the ends of the arms *R* and *U*, advancing, complete the link and the bar *Q* recedes, allowing the link to fall into a sheet metal chute and then to any desired receptacle. A coil of wire arranged on a freely revolving reel serves to present the stock to the feeding mechanism of the machine.

In operation, the machine turned out about 4,000 pieces an hour without any trouble. It was also arranged for other jobs of bending besides the example given, and performed the work equally well.

C. D. KING.

Knockdown Steamboat Construction.

Editor American Machinist:

Noting your comment on the construction of the steamer "Weetamoo" on Lake Sunapee at page 1013, I would state that this plan of building a vessel in one part of the country and shipping it to another is not confined to Switzerland, as would be inferred by reading your article, but such construction is practiced in other countries, including our own. Several of the shipyards of our coast make a specialty of knockdown jobs. Two firms in Wilmington, Del., have this year contracted for this kind of work. One vessel was erected on the shores of Lake George and another taken apart and shipped by schooner to South America. It is the common practice also in England, where shallow draft vessels for Egyptian, Indian and Chinese service are built at home, taken apart and shipped to destination, where they are erected.

The writer has assisted in constructing such class of work, and in the smaller orders the boats are sometimes built in sections, each section being floatable because of light water-tight bulkheads at either end. The upper works, machinery, etc., are packed in these sections, which are shipped to the point of destination and there assembled by riveting together the transverse bulkheads.

In larger work each plate is fitted, the rivet holes punched, then the plate bolted in place and the vessel erected, only bolts being used, however. The job is then knocked down, shipped, and riveted together at destination. J. W. M.

Roller Bearings.

Editor American Machinist:

I notice at page 851 an article signed S. P. Y., who says that he is looking for all the information he can find about roller bearings, and that he has had unfavorable experience with them. No doubt these bearings, if not made in proper proportion to the load to be carried, will not work well and perhaps crush down. Some six years ago we equipped our factory on all main lines with spiral Hyatt roller bearings, first sending the manufacturers the dimensions and allowing them to figure the sizes as they thought best. After these bearings were delivered, and before being installed, we had a brake test made to show the amount of horse-power consumed in turning the entire lines of shafting, 600 feet, with 104 babbitt bearings. The same brake test was applied after the roller bearings were in place, and this is a condensed summary of the report made by the engineers:

The available power for manufacturing purposes after turning the shafting in babbitt bearings was 14.98 horse-power.

With roller bearings we had 22 horse-power, showing that we had gained 7.02 horse-power by putting in the roller bearings.

We had one bearing next to the main belt pulley that was always getting hot and melting out the babbitt. After placing a roller bearing there we had no more trouble with hot boxes. So well are we pleased with the performance of these bearings that we install them for all new line shaft bearings.

Would say that the expense of repairs is insignificant—not one-tenth part as much as the babbitt boxes cost us. We think that in every case the bearings should be made in proper proportion, and feel quite sure that if S. P. Y. would allow the makers to install their bearings, figured to proper sizes, in the places complained of, he would have no more cause to complain, but, on the contrary, would be greatly pleased with the results. I should be pleased to give him any further information he may care for. G. W. J.

Editor American Machinist:

Some years ago the writer gave you our experience with the Hyatt roller bearings, which were installed because our water power was not large enough for our increase. If S. P. Y. had our experience he would not condemn roller bearings. They must be large enough for the load and have end play to allow for stretching. Probably our company was the first to give the Hyatt Company a good sized order, and we installed the bearings on old iron shafting between twenty and thirty years old, which was worn out of round and was tapering, but by attention and care I am pleased to say we are still of the opinion that they are all right if reasonable care is taken. We oil them once a week, and almost every year order additional ones, as our plant increases. We have them on our jack shafts, 4 7-16 inches diameter; on our horizontal water wheel shaft and on all our main lines running from 210 to 550 revolutions per minute. We have in use about 200 of all sizes and have no trouble with them in any way. When first installed, on account of the shafting being tapering, we examined them frequently, and as they stretched and wore to correspond to the shape of the bearings, we ground off the end of the rollers to allow them to stretch. We have used them for five years on loose pulleys for circular saw idlers. As for ball bearings, would say that I have used them in connection with a machine attached to a buff for buffing brass shells. The old bearings were renewed every two months, while the ball bearings have been renewed but twice in six or seven years.

In conclusion I would say that if ball or roller bearings are made for the load they are to carry and have care, they will run easier and wear longer than any bearing known to me.

THOS. W. R. MCCABE.

Brain Workers.

Editor American Machinist:

I see that your oleaginous disquisitor—that ought to designate him satisfactorily—has been indulging in a kick against those who fail to understand and appreciate the mechanic or to accord to him the status which equitably should be his. I am glad to see it. A good kick is often as good for a man as a good cry is for a woman, and it has the double advantage that not only the kicker but also the kickee, and often more than one—if they only know they are kicked—may be benefited by it. Let us all kick.

It requires no effort for me to kick, as I am never without provocation. There is one thing that disgusts me continually, and that is the conceit and arrogance of those who would usurp for themselves and monopolize the title of "brain workers." There is a society, or association, or organization of some kind, for mutual admiration and self-glorification calling itself pre-eminently and par excellence *The* Brain Workers, and the sole particular upon which they base their claim to the title is not that they are the doers of anything in the world, or the planners of the doing of things, but simply that they are slingers or stringers of words. Their occupation individually is simply the collecting and arranging of words to appear

on the printed page, and these, forsooth, are *the* brain workers, it being understood by all the world that brain work is the highest work of which man is capable.

If these makers of occasional books are indeed the brain workers, and if what they do is the typical and highest brain work, then must there be some other organ than the brain more prolific of accomplisnment and more deserving of high appreciation. I, however, have been taught to have great respect for the human brain as a very necessary, and, in its special function, a very effective organ of the body. It has to do with the driving and directing of all the activities and accomplishments of men. I believe that all work is ultimately done by brains, so that I cannot possibly have any sympathy with the application of the term brain work to any one special and narrow line of occupation.

The typical, self-styled brain worker shows the kind of work he can do, and what he will modestly confess is his best work, in writing a sentimental and artificially pathetic whine about "The Man with the Hoe," discovering that he is "twin brother of the ox" and all that. Why, bless your poor little heart, so far as your help is concerned, the broad prairies of America might be covered to-day with your twin brothers of the ox, were it not that the true and real brain workers, working with the brains that drive to deeds rather than to words, have emancipated the man from the hoe and set him to ride upon the modern agricultural machine and the brain worker will soon do the same for Europe and for all the world, but it will not be the brain worker of the jingling rhyme or of the involved and long-worded page.

It is time for us, and it was high time long ago for us to get up and protest against the claims of *the* brain workers. The great world does not accept and endorse these claims. We can judge of the world's estimate of things by the sifting that continually goes on, and by noting what is retained and what is discarded. It is mighty little "brain work," as these fellows call it, that is now considered worth saving or that is carried very far along the road. Some of it is carted a little way and then it is thrown out, and less and less of the newer products of the professional brain workers are picked up and carried along. While lots of books are still being made there never were so few thought worth saving beyond the year of their issue, and nobody need be thinking that by and by we will begin saving them again, for they will have no sweet by and by.

It is not so with the brain work of the scientist, the engineer, the mechanic. These are as truly brain workers and as hard brain workers as the others, and what they do is the brain work that really lives. Every scrap of new information concerning the materials and forces of the physical world is adopted, adapted and permanently employed and embodied in the continual improvement of current methods. The true brain work of the shop or gang foreman in planning and watching the details of construction, as fast as it leads to new advantages in the doing of the work or increasing the output, at once becomes a permanent part of the shop processes and lives and helps in accomplishment. The new idea of the brain-working journeyman may never get into the book of the professional brain worker—be buried there you might say—but it is quite likely to get into the columns of the AMERICAN MACHINIST, and through that means find more extended and permanent employment in the shops throughout the land.

Now, I am far enough from despising literary facility. We do indeed need to catch on to the trick of the word slinger to the extent at least of being able to communicate the results of our kind of brain work without effort and to narrate or record what our brains, or what our hands directed by our brains, accomplish. The engineer, the mechanician is largely not recognized and appreciated as a brain worker simply because the world does not know and because the worker does not tell, has not the habit and largely has not the ability to tell, how strenuously and continuously he thinks, plans, investigates, compares, selects, arranges and otherwise exercises his highest thinking powers. We must cease to be such sticks and dummies to the world at large. We must learn to pose to some extent, I suppose; learn to tell of our tedious and protracted processes as well as of our tasks accomplished. When we fully get into this way we will doubtless be better understood to be brain workers and be more respected accordingly.

It will be a curious thing if after having acquired this facility of language we also begin along with it to be proud of this little achievement and begin to glorify and rejoice in this talking and writing business as being itself the real thing instead of what we started to talk about. Then indeed we will become nothing but mere "brain workers" of the type that I complain of, and the world after that will not be helped along much farther by our efforts. We may shove ourselves too much to be any more shovers of the world; we will have become professional, self-conscious, ostentatious "brain workers."

TECUMSEH SWIFT.

"How to Show a Shop"—An English Improvement.

Editor American Machinist:

"B. W. T.," at page 706, describes how a party of the A. S. M. E. were shown through the shop with which he was connected. Some account of two other shop visits may be *apropos*. How these came about was as follows: Some little time ago it struck me that it might do some good, and could scarcely do harm, if a few visits to other workshops, etc., in the neighborhood were paid on Saturday afternoons by such members of the staff and workmen employed by our company—Meldrum Bros., Ltd.—as cared to take advantage of the opportunity. Through the kindness of our neighbors, up to the time of writing, the following visits have been paid, viz.: to Messrs. S. N. Brayshaw, milling cutter manufacturer; Chas. Churchill & Co., Ltd.; the Atlas Engineering Company, machine tool makers; the Municipal School of Technology; Geo. Richards & Co., Ltd., machine tool makers, and Browett, Lindly & Co., Ltd., high speed engine builders.

The general results in stimulating interest in workshop methods and encouraging good feeling between all grades of employees are decidedly good. Shortly after the commencement of the visits, a letter appeared in a local evening paper, from a workman, asking employers to grant reasonable facilities for their workmen obtaining some knowledge of the methods of manufacture of their specialties in their entirety. As the writer of the letter stated, in many shops it is a matter of considerable difficulty for a workman to see anything outside his own department, such a desire being treated as in the nature of a breach of discipline. The letter concluded with an expression of opinion that it was unreasonable to expect employees to endeavor to improve their technical attainments and interest themselves in their occupations, when their workshop horizon was deliberately limited—not necessarily vindictively, but, from commercial and disciplinary considerations, carried beyond needful limits. As a sequence to this letter, a visit not at first contemplated was added to the series. The directors of Meldrum Bros., Ltd., formally invited all the employees to visit *their own works* on Saturday afternoon, April 12, 1902, to inspect the equipment throughout and have the distinctive features of the company's products explained. The underlying idea was at first scarcely grasped, but after the first surprise had worn off, all ranks put their shoulders to the wheel and made the affair a genuine success. Quite spontaneously, special finishing touches were given to the machinery and power equipments, and at the close of the inspection pretty well everyone was astonished at the amount of knowledge they had gained as to the resources of their own works. Opportunity was also taken to invite a number of shareholders, and commercial representatives who are in the habit of calling on the company on business matters.

As the present building is most unsuitable for its purpose, being on no less than six floors, and in shape somewhat in the form of a mutilated triangle, special arrangements for insuring everything being seen without discomfort were called for. Six "stewards" were appointed, one to each room, to explain the special features therein, and six "guides" to conduct the

guests to each room in succession. The visitors were marshalled into six sections outside the building, and, on the works bell sounding, were taken by the guides to the several rooms, where the stewards were already in attendance, and the inspection commenced simultaneously in all the rooms. Every twenty minutes the bell sounded and the parties were conducted to the next room. In a little over two hours everybody had seen everything, and an adjournment was made to an adjacent restaurant, where tea was discussed, followed by a musical program. The latter items were not mentioned in the invitations.

Among the interested guests was Mr. Tulloch, of the British Westinghouse Company's toolroom department, who much appreciated the underlying educational scheme involved in the visit. As before stated, the affair gave much pleasure, and tangible profit, a well-printed program (I enclose one for the editor's information) materially assisting and serving as a souvenir of the occasion.

The second visit paid to Meldrum Bros., on June 21, was taken part in, on the invitation of the directors, by representatives of the staff and workmen of the concerns previously mentioned, and was equally well appreciated, being carried out on the lines indicated above. Through the practice obtained in the first case the staff were quite accustomed to their role of expounding their particular lines, a state of things, as recently pointed out by Mr. Hans Renold during a discussion on Technical Education, of some value to the employing company. Light refreshments—served on the roof of the works—made an unexpected but appreciated concluding item, the day being very hot, and a good view of the city obtainable. There appears to me no reason why industrial "at homes" should not become a recognized part of the general scheme of industrial and technical betterment. Not one, but many, methods will need to be employed to ameliorate the inevitable apparent harshness incidental to rapidly changing industrial conditions. It may be added that a new shop now rapidly approaching completion will simplify future arrangements and conduce very considerably to comfort and efficiency in every-day working.

JAMES VOSE.

Manchester, England.

"Good Enough" in the Office of the Works.

Editor American Machinist:

If your columns are not yet closed to the discussion of the "good enough" standard, I would like to say a word upon the trouble caused by this question in departments of industrial concerns altogether outside of the shops. Particularly in the cost department it is a pretty hard question sometimes to decide where to set the limit indicated by these words. The man who considers he has reached it when his work is just good enough to escape censure has set it too low. On the other hand, the man who will spend as much time chasing up an accurate record of cost for some spoiled work which is being transferred from stores to scrap, who will spend on this detail the same length of time and be as determined to be exactly correct as he would upon estimating for a tender where large amounts might be involved, has set it too high. The workman who has set his standard of good enough exactly where it belongs in mechanical matters is inclined to think that any place will do for the same standard as regards any clerical work or records in which he may be interested. If workmen and foremen would only realize that a little carelessness on their part in transposing the figures of an order number may upset the record of cost to a degree that renders it valueless, they might take more pains to be accurate in this respect. If foremen knew how important it is that the cost department should be able to trust implicitly to their orders bearing the right number, much friction in the office would be avoided; but they won't do it. They seem to think that as long as they turn out a good job, and have only spent a legitimate length of time on that particular work, it does not matter much whether the records show that on a former occasion they spent more or less. It is the same thing in the stores; they have an idea that as long as they charge out everything they issue they will be out of the woods at time of inventory. So they will, as far as not being called upon to explain a shortage of material, but there has been a great shortage of time during the year, tracing up mistakes made by them in the account or order number to which they charged goods, and this would be avoided if they would only raise their standard of good enough a little bit as regards clerical matters. To go back to the clerk who spends so much time chasing up unimportant matters, I was asked only to-night, if 18,881 articles turned out by a laundry cost $116.67, how would the inquirer tell his chief how much one article cost. He wanted to know how to *say* $\frac{1}{18881}$ of a cent. When I suggested so much per hundred it would not go, because the chief had told him to find out how much *each*.

KENNETH FALCONER.

"How to Brace Up a Shop."

Editor American Machinist:

A little incident that occurred not long ago may be a help to "Dutch" in finding the cause of so much trouble in the shop.

An Irishman had a son about sixteen years of age working in a machine shop as an apprentice. One day the boss discharged him and Murphy called on the foreman to learn the reason. The boss said, "The boy is slow to learn and I have not the time to bother with him," and in a joking way he remarked, "His head is not shaped right to learn the machinist trade." The boss took a piece of chalk and made a mark on the boy's head and said to Murphy: "See that chalk mark?" "I do." "Well, that's the location of the machinist bump, but it is too small on your boy." Next day Murphy called at the shop and said: "Say, Boss, the boy is all right now; I struck the chalk mark with a brick, now the boy has a machinist bump you could not put down with a hydraulic press in six months."

Say, "Dutch," put a chalk mark on your managing bump, then call on Mr. Murphy. He has that brick yet.

UNEEDABRICK.

Editor American Machinist:

Your correspondent "Dutch" seems in grievous trouble. It seems to me that with his force of but twenty-four men he could have a very tidy place, even though it may be a job shop. I would suggest that he first select the brightest light among them and make him tool-man, for I don't believe he has one, or a tool-room either. Next he must set aside a place for him and the tools and make him make the other fellows tidy with the taps, drills, etc. Next let him hire a handy man, a laborer who can sweep the place *clean* everywhere, morning and near closing time, and have each workman clean his machine and dust off his bench just a short while every night before the going-home whistle blows.

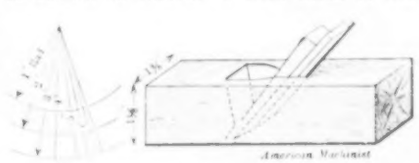
Some men are untidy and shiftless by nature, others by example, and one of the former will make many of the latter if allowed the chance. It's for "Dutch" to post the above rules and see that they are obeyed (unless he be afraid of his men) and a clean, tidy shop will be his.

H. E. B.

Small Planes for Patternmakers.

Editor American Machinist:

Last Christmas, Santa Claus was unusually kind to my little son, sending three small boxes of tools. In each box was a small plane made of beech, the dimensions as shown in sketch. I took them to the shop and planed the bottoms to the radii, as shown, and from an old file made blades or knives to suit. These worked so well that I ordered five more at my hardware store. Now I have a neat set of core-box planes which take up little space in my tool-chest.



CHEAP PLANES FOR PATTERNMAKERS.

X. Y.

A Pelton water wheel in Nevada which cost $125, with $10 for repairs, has in five years furnished power for the crushing of 60,000 tons of auriferous ore.

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The Cost of Home-Made Tools.

A contributor sent us an article recently in which he gave us a detailed account of the design and construction of a certain machine tool which had been built in the shop in which he was employed, for use there, this being believed to be, all things considered, more advantageous than to purchase a similar tool at that time. Our contributor mentioned in the article, among the reasons given for this decision, the matter of price; saying that the price quoted by the builders was high, and, finally, that the machine made in their own shop cost only about three-fourths of the price quoted for a similar machine. He could not understand why we eliminated these statements, and why we did not consider it proper to publish them may be of interest to other contributors. The fact is, as all who have given the matter any consideration know, that cost-accounting is a very intricate science. Surprisingly few manufacturing establishments really know a certain machine's cost to produce, and it is morally certain that a great many concerns manufacturing machinery to-day continue to be in business simply because on some machines they build they make up the losses on others; not knowing but what all machines built by them contribute to the profits shown by their balance sheets at the end of the year. Different concerns have different methods of accounting, and so well recognized is this fact that in the organization among the metal bedstead manufacturers of Birmingham, and which we have referred to as being a novel form of trade organization, it is specified that in deciding whether a given manufacturer is really making the profits on his goods which are required by the association to be made, the methods of determining the cost shall be according to the rules laid down by the society, and that the statement of cost will not be taken upon the authority of the manufacturer himself.

Aside from the fact that methods of cost-accounting differ, the tendency where a machine is built in the shop for which it is constructed is not to charge that machine with what is commonly known as the "shop burden." Very many home-made machine tools have been considered cheap simply because they have not been charged with anything but the materials and the labor, though it is needless to say that a tool builder who should charge costs and base his selling prices on that principle would not long remain in business, unless he had the resources of several national banks at command.

There is, as a matter of fact, no very great margin in machine tool manufacture as carried on in America to-day, and we believe no margin anything like such as would be inferred from the naked statement that a machine had been designed, drawings and patterns made for it and a single machine constructed at three-fourths of the selling price of a similar machine, as made by the regular builders.

Water Meters in Memphis.

The Memphis *Scimitar* is, it seems, opposing the use of water meters in that city and is advancing the usual, worn-out and utterly fallacious arguments against it. It sets up a howl in behalf of the wage earners and others who may have to pay for water wasted through leaky pipes within their premises, and gives an instance of a woman who owns a tenement house, for which she receives $14 per month rent; her water bill for one month was $12.45.

While this seems wrong upon the face of it, it will probably be found upon examination that most of the water recorded by the meter was wasted either through defective plumbing or carelessness. Now, nothing is more certain than that someone has to pay for all water wasted as well as for that which is used. Can the *Scimitar* name anyone that has a better right to pay for wasted water than the person who wastes it?

The fact is, both reason and experience show conclusively that the only fair and just way of charging for water is by the gallon, as measured through a meter. Then each consumer pays for what he draws out of the mains, and those who are careless or prodigal with the water pay for what they waste, instead of being able to shift it on to others, as they in fact do where meters are not used. No one would think of distributing illuminating gas and basing charges for its use upon the number of burners in the house, and it is quite certain that if gas were distributed in that way all gas bills would have to be larger to cover wastage. With a meter each person pays for what he gets and does not pay for his neighbor's waste or extravagance. There is no valid objection to it, and no other method of selling water ought to be thought of. The *Scimitar* would do well to inform itself about the matter. It will find that meters, by discouraging waste of water, enable water companies or municipalities to furnish water for actual use at lower rates, and that the meter affords the only known means of securing a just and fair distribution of charges among consumers.

Effects of a New Rule About Freight Cars.

At its recent convention at Saratoga the Master Car Builders' Association adopted the rule of per diem charges for freight cars used or retained by roads other than those to which they belong; abrogating the old rule of mileage charges. The old rule furnished no incentive to the roads for returning foreign cars. The new one does furnish such an incentive. As to the results of the new rule, *The Railroad Gazette* speaks of them as follows:

"Never, since Christopher Columbus discovered America, have so many freight cars been at home. A recent journey of

about 2,000 miles, mostly by daylight, over two trunk lines, showed strings of cars, which made one think of the hard times of 1894. But it was amazing to see how few foreign cars were included in these trains. It was interesting also to observe the acute sensitiveness of the superintendent of transportation to the sight of the initials of a foreign road. No such job of house cleaning has been done on the railroads of the United States for many years. It must follow that greater use will be got out of the freight stock, and car builders have a good deal of apprehension that a corollary of this will be a diminution in the activity of car building. It would not be surprising if this were true, but, on the other hand, many railroads are now running cars which they cannot afford to run because the capacity is too low. Lightweight cars will be condemned and broken up and replaced by heavy cars, and this movement will, in some degree, offset the lessened demand for cars following on their better distribution and more active use."

Constitution of the National Tool Builders' Association.

Last week we referred to the National Machine Tool Builders' Association, organized at Niagara Falls. Following we give the Constitution of the association:

ARTICLE I.

This association shall be known as the National Machine Tool Builders' Association.

ARTICLE II.

The objects of this association are to promote the interests of the machine tool builders in the direction of good fellowship and the liberal discussion of subjects pertaining to the manufacture and sale of machine tools.

ARTICLE III.

Section 1. Members of this association shall be persons, firms or corporations engaged as principals, owning or controlling manufacturing plants, operating exclusively in the manufacture of machine tools.

Sec. 2. Applications for membership under Section 1, Article III, shall be recommended by at least one member in good standing, and shall be admitted to membership when elected by the majority vote of the members of the association.

Sec. 3. Resignations of members shall be tendered to the secretary of the association in writing, and shall be accepted only when said members' dues are fully paid.

Sec. 4. A member may be expelled only by a three-fourths vote of the association.

Sec. 5. Each member shall be entitled to one vote. Where corporations are represented by more than one member said corporation is entitled to one vote only.

ARTICLE IV.

Section 1. There shall be an annual national convention held in the month of October, at such time and place as the association shall appoint.

Sec. 2. The convention shall be composed of duly accredited representatives of members in good standing. Members may be represented by proxy, but said proxy must be a member of the association.

Sec. 3. The annual convention shall elect national officers by ballot as follows: President, first vice-president, second vice-president, secretary and treasurer, who shall be elected for a term of one year, or until their successors are qualified.

Sec. 4. Special conventions may be called by the president at the written request of eight members of the association.

Sec. 5. Fifty per cent. of the votes of the association shall constitute a quorum of the convention.

Sec. 6. The five above enumerated officers shall constitute the Executive Committee.

Sec. 7. The association at its national conventions shall make such laws, define such policy, adopt such resolutions and render such decisions as shall further the interests of the association, and the acts, resolutions and decisions of a national convention shall be final and binding upon all members.

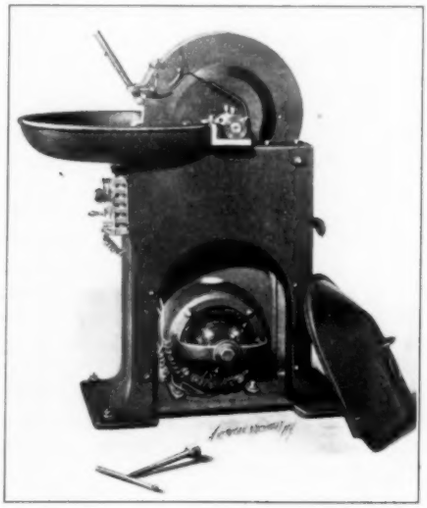
ARTICLE V.

Section 1. This constitution may be amended by a two-thirds vote of the association members in national convention assembled.

Some New Things.

ELECTRICALLY DRIVEN WATER TOOL GRINDER.

The accompanying half-tone illustrates an electrically driven water tool grinder which has recently been brought out by



ELECTRICALLY DRIVEN WATER TOOL GRINDER.

the Ransom Manufacturing Company, of Oshkosh, Wis. The emery wheel is 20 inches in diameter by 1½ inches face. The main bearings have ring oilers. The motor will be seen to be entirely enclosed, its shaft projecting through the side of the base which is away from the observer, where a vertical belt connects it with the emery wheel arbor. The removable support for the wheel dresser is shown in position.

A Florida Disenchantment.

Down in Florida a few years ago at one of the famous summer resorts was a small street railroad—a little affair that did not amount to much, but was supposed by its proprietors to be sufficient for all ordinary purposes. One day in the course of a discussion the owners were accused of being old fogies and behind the times. "Why don't you get together and be up to date?" they were asked. "You really ought to have a modern equipment for a place of this character, instead of an old road of mule-drawn cars that date back to the flood."

After considerable deep meditation and with many misgivings the road was ordered changed to an electric line, and an 80 horse-power equipment was ordered. The outfit arrived and was installed, but for some reason failed to operate properly. An outside expert was then called in to examine the plant and locate the trouble. At a special directors' meeting he reported that the rated efficiency of the plant was 80 horse-power and that 80 horse-power were being used for the actual operation of the road. At this one of the directors jumped up and exclaimed excitedly: "My God! 80 horse-power for what we used to do with six mules? I guess we had better go back to the mules."—*Electrical Age.*

Technical Publication.

The Shaw-Walker Company, of Muskegon, Mich., inform us that the book, "The Cost of Production," published by them, is sold at $1 in paper covers and $2 in cloth covers. Our notice of the book, at page 1031, stated that we understood the book to be "intended for free distribution to interested parties."

Press despatches tell of the queer exploit of a storm at Detroit on July 27. The wind struck a Brown hoist or traveling crane in the Wyandotte shipyard with such force as to break the chains with which it was anchored at the end of its runway, and it ran to the other end and off, making a leap to the top of a car ferryboat, wrecking itself and a goodly portion of the boat.

Lieut. Godfrey L. Carden, who is connected with the Department of Machinery of the St. Louis Exposition, has recently been visiting some of the prominent machine tool builders of the country and reports that he finds them quite interested in the St. Louis Exhibition, and that concerns that occupied from 500 to 700 square feet of space at Chicago are, for the St.

Louis Exhibition, asking for about three times that amount of space. The indications are, he thinks, that the exhibit of machinery will be a very large one, and that it will be very largely and generally participated in by American builders.

Through the courtesy of Mr. R. P. C. Sanderson, superintendent of motive power, acting with the approval of Mr. J. M. Barr, vice-president of the Seaboard Air Line Railway, Purdue University is in receipt of a full-sized model, accurate in all of its details, of an early locomotive. Mr. Sanderson states that the model represents the locomotive "Tornado," which was the second owned by the parent roads now forming the Seaboard Air Line Railway. It was purchased in England and placed in service in March, 1840. It has a single pair of drivers, a four-wheel truck and a cylindrical firebox. A tender carried on four wheels is attached.

Personal.

F. H. Colvin, whom our readers will remember as a former valued contributor and who of late has been connected with *Railway and Locomotive Engineering*, has opened a technical book business at 256 Broadway, New York. He will publish as well as sell standard works, and it is said will bring out as his first venture a book by our contributor, E. R. Markham, on hardening and tempering steel.

Commercial Review.

NEW YORK, Monday, July 28.

In machinery circles considerable encouragement is derived from the action of Southern producers of pig iron in deciding upon $17 as the basis of all sales for the first six months of 1903.

For some time past there has been an impression that lower prices would prevail for the same period. The fact that they do not is looked upon as conclusive proof that the industrial prosperity of the country bids fair to continue for some time to come. That this is recognized by consumers of pig iron is shown by the large purchases they have already made for next year, and by inquiries which indicate the execution of some good-sized orders in the near future.

Machinery manufacturers argue that just so long as raw material continues to be in good demand and at steady prices, the finished product must necessarily come in for corresponding consideration. Several machinery houses have been anxiously awaiting some definite information on the probable trend of the pig-iron market for next year, and now that they have been favored in this connection, look forward with confidence to considerable activity in their line in the near future. This is principally because they had learned that some large orders for machinery were held in abeyance, especially among projectors of new industrial enterprises, in the belief that a decrease in the price of pig iron could be looked for, and lower prices for the finished product follow as a natural consequence.

Manufacturers of agricultural machinery report an unusually brisk demand for their products, particularly from European centers. Outgoing steamers furnish proof of the fact, and a visit to any dock of note in and around New York shows a large amount of agricultural implements for shipment abroad. South African purchases are especially heavy, and A. M. Churchman, of Johannesburg, is now on his way to this country with orders which will mean, it is said, an expenditure of between $300,000 and $400,000. It is a significant fact that a large portion of iron sold for delivery next year has been to manufacturers of agricultural machinery, indicating that the latter look upon the outlook for future business as decidedly hopeful.

Manufacturers of railway machinery and appliances of all kinds expect some big orders soon, in consequence of the big crops that are assured. Western railroads have been particularly heavy buyers of cars and engines during the present year. The quarterly report of the Pressed Steel Car Company, issued a few days ago, bears testimony to this statement, the company having $14,000,000 worth of business on hand, enough to keep its plants going until the end of November.

American enterprise has not been felt to any great extent in Japan, especially in the manufacturing line, because the laws of the country prohibit foreign ownership of land. Anthony J. Brady, whose domicile is at Albany, but whose business activities are mostly confined to this city, has come to the conclusion that gas plants in that country can be made remunerative, and has accordingly interested American capitalists to the extent of providing $2,100,000 for making additions to the plant of the Tokio Gas Company, in Tokio, and about $1,000,000 for extending the same company's business in Osaka. Mr. Brady's experiment will be watched with considerable interest, and if his expectations are realized, American capital will doubtless find a profitable field in Japan, all advices being to the effect that the industrial domain of that country is as yet in its infancy as regards its proper development.

The Lackawanna Steel Company, which is building an extensive plant at Stony Point, N. Y., is now giving out orders for the necessary machinery. Gas engines will be used in connection with the four large blast furnaces the company is erecting. The contract for these has been let, but President Scranton is unwilling to disclose the identity of the parties. He says the engines will be of German type, but will be made in the United States by an American manufacturer. He expects a large saving by the use of gas instead of steam engines. The new engines will cost nearly $1,000,000.

The Crocker-Wheeler Company have received the following orders for their motor-driven tools: One 150-kilowatt engine type generator, from the International Silver Company, Meriden, Conn.; one variable-speed motor equipment from the Pond Machine Tool Company, Plainfield, N. J.; one 150-kilowatt engine type generator, and ten 10 horse-power motors, from the American Knit Goods Manufacturing Company, Brooklyn, N. Y.; eleven motors of various sizes from the Trow Directory Company, Brooklyn, N. Y.; complete lighting plant from the Stewart Hartshorne & Co., Newark, N. J.; three 50 horse-power special motor equipments, from the Allentown Rolling Mills, Allentown, Pa., and two 35 horse-power motor equipments, from the C. Pardee Works, Perth Amboy, N. J.

The Chicago Pneumatic Tool Company have received so many orders for air compressors that they decided a few days ago to keep that part of their plant devoted to the manufacture of them running day and night. The men will work in two shifts.

The Hall Signal Company, of this city, have received an order from the Chicago & North Western Railway for a complete automatic block signal equipment, on the company's main line from Rochelle, Ill., to East Clinton, Ia., a distance of 64 miles, double track.

The International Paper Company have completed plans for some extensive additions and alterations to their plant at Bellows Falls, Vt., which will involve an expenditure of at least $300,000. Quite a large amount of new machinery will be installed, the majority of which has been contracted for. The Allis-Chalmers Company, of this city, has been given the order for a Reynolds-Corliss engine, which will have a cylinder 16x42 inches and a driving wheel 12 feet in diameter with a 26-inch face. The Aultman & Taylor Company, of Mansfield, O., will supply two 705 horse-power boilers. E. D. Jones, of Pittsfield, Mass., received the order for two 1,500-pound beating engines.

According to advices from Niagara Falls, several mammoth power establishments are among the possibilities of the near future in that vicinity. The Power River Power Company, recently incorporated at Albany with a capital of $5,000,000, is the leading spirit in the matter. The plant it intends to build will increase the horse-power capacity of the city by 200,000. The Hydraulic Power & Manufacturing Company have purchased 100 acres of land, and will erect a plant upon it to have a capacity of 100,000 horsepower. It is also said that the William A. Rogers Company, Ltd., now operating large power plants at Northampton, Mass.; New Bedford, Mass., and Oneida, N. Y., will consolidate them at Niagara Falls.

The Standard Steel Car Company is

equipping its new plant for electric driving throughout. A recent purchase from the Westinghouse Electric & Manufacturing Company comprises two 375-kilowatt, A. C. generators, one 400-kilowatt, D. C. generator and a 300-kilowatt rotary converter for use as a connecting link between the two. This company has also purchased about fifty induction motors, which will be used largely for direct connection to machine tools.

The plans for the new plant of the Cleveland Pneumatic Tool Company are just about completed, and contracts will be let at an early day for the construction of the buildings. The company has just opened up an office at 411 Park Building, Pittsburgh, Pa., represented by Chas. L. Nelson, and at 34 Lemoine street, Montreal, Canada, represented by N. J. Holden & Co.

The Goulds Manufacturing Company, of Seneca Falls, N. Y., report a very heavy demand for all of their different styles of pumps. This is especially true of their line of large triplex power pumps, for which they have recently erected a special plant. They are so heavily filled with orders that they are in great need of additional machinists and have permanent employment for a number of new men if they could get them.

The Buffalo Forge Company, of Buffalo, N. Y., has received an order from the Continental Coal Company, of Gloucester, Ohio, for three 250-inch fans for installation in its mines. The fans are of the ¾ housing type and of the special width of 72 inches. The sides are built of extra heavy steel plate and are thoroughly braced with angle irons of ample size, effectually preventing all vibration. The blast wheels of these fans are of the usual centrifugal type. The radial blades or vanes with backwardly curved tips are supported by two spiders of wrought-iron tees springing from cast-iron hubs and are further stiffened by the conical side plates. The fan shaft is supported independent of the housing by two standard Buffalo self-alining, chain-oiling outboard bearings mounted on masonry pedestals. This plant is similar in many respects to that of the Modoc Coal Mining Company, located at the same place and recently installed by this company.

Westinghouse, Church, Kerr & Company have recently booked a number of foreign orders for Westinghouse products through their several foreign representatives. Among them are: Indwe Railway, Coal & Land Company, Cape Colony, South Africa, a complete railway system for operation in the De Beers Mines, Cape Colony, consisting of two 250 horse-power compound single-acting engines, direct connected to Westinghouse generators, for furnishing current to Baldwin-Westinghouse mining locomotives, of which there will be six; Juan Martinez, Linares, Spain, one 125 horse-power, three-cylinder gas engine operating on producer gas and belted to two 37½-kilowatt Westinghouse generators for power purposes; Montezuma Lead Company, Santa Barbara, Mex., one 75 horse-power compound engine; the Osaka Club Hotel, Tokio, Japan, a complete electric service for lighting and power, for which one 25 horse-power standard engine direct connected to generator will be installed; Graham Brothers, Stockholm, Sweden, two 200 horse-power compound engines for power purposes; Takata & Co., Tokio, Japan, one 150 horse-power compound engine; the De Beers Consolidated Mines Company, Ltd., Cape Colony, two 1,000-kilowatt turbo-generators, for delivery the first part of the coming year.

The steam loop and Holly gravity return system has had many new applications abroad, prominent among which are the works of La Gran Fundicion Central Mexicana, Aguas Calienta, Mex., and the immense works of the British Westinghouse Electric & Manufacturing Company, Manchester. At these works will also be installed several 132-inch by 22-inch grate Roney stokers in addition to their already large equipment. Roney stokers will also be installed in the power plant of the Mersey Railway, this order covering seven 158-inch by 28 grate and two 136-inch by 24 grate stokers. Another order was from the Coatzacoalcos (Mexico) Light & Power Company—a complete air pump and condenser outfit, in connection with their power plant.

The Westinghouse, Church, Kerr & Co. have moved their Pittsburgh office from the first to the eighth floor of the Westinghouse Building. The change is the direct outcome of largely increased business in the district, and is accompanied by the organization of two new departments, viz., the engineering and construction departments, in addition to the original sales department, and the acquirement of a commodious reception room devoted exclusively to the convenience and entertainment of visitors and patrons.

Bids were to have been opened by the Water Department of this city on July 24 for the establishment of a new pumping station at Baldwin's, L. I., which will cost about $75,000. Almost at the last minute it was discovered that the necessary advertisement covering the matter had not been inserted in the Brooklyn newspapers, as provided by the Greater New York charter, and the bids were not opened. The re-advertisement of the specifications has been ordered, and it will state that the bids will be opened on August 7.

At the recent convention of the American Boiler Manufacturers' Association, held at Atlantic City, it was decided to petition Congress to repeal the laws, enacted over twenty-five years ago, limiting steam pressure to one-sixth of the tensile strength of simple riveted boilers. In the navy, quadruple riveted boilers are used almost exclusively, yet any additional steam pressure is prohibited.

The report of the International Steam Pump Company for the three months ending June 30, shows a marked improvemen over that for a similar period last year. For the three months in question the orders received amounted to $2,759,155, against $2,313,077 in the corresponding period in 1901. On June 30 the orders on hand aggregated $5,653,401, against $2,439,182 at the same time a year ago.

Recent statistics of our foreign trade for 1901 show that iron and steel comprised the bulk of manufactures exported. The total values were as follows: Europe, $43,812,323; North America (outside of the United States), $43,518,903; South America, $8,754,800; Asia, $8,902,967; Oceanica, $8,871,602; and Africa, $2,368,635, making a combined total of $117,319,320. Iron and steel formed the largest single items of our exports to all of the above countries, with the exception of Asia, which took more of our refined and manufactured oils than anything else, with iron and steel a close second.

Consular reports from Coburg, Germany, are to the effect that for a long time the Vulcan Shipbuilding and Engineering Company has been looking for a suitable place close to the North Sea for another yard, as the building of vessels of the largest dimensions is becoming impossible at Stettin, owing to the shallow draft of water in the River Oder, and even in the Baltic itself. The River Elbe has been chosen as the locality for the new yard, and the intention is, at first, to build only large vessels here, the engines for which, and as far as possible the boilers also, will be supplied by the Stettin works.

The phenomenal development of the iron and steel industry of the United States led the British Iron Trade Association to appoint a commission last year to inquire into the industrial conditions and competition of the United States. The report of that commission, which has been recently presented, is briefly reviewed by the London *Commercial Intelligence*, a copy of which has just reached the Treasury Bureau of Statistics. It says:

"It is indeed a marvelous and, to the British manufacturer and trader, in some respects a most discouraging story. The British Iron Trade Commission gives details of the mineral resources of the United States as affecting that fundamental industry—the manufacture of iron and steel; show the extraordinary richness of the principal fields of coal, iron ore, and kindred minerals and demonstrate by concrete examples how the natural inventiveness of the American has enabled him to apply to the operations of production and distribution a wealth of original ideas and methods that are as yet little known in Europe. It is also made manifest how on land, on lake, on river, and on canal, the American people have applied their minds to the solution of the conditions and problems of cheap transport until they have at last attained a level of rates and charges

such as we have hardly had any experience of on this side of the Atlantic. It is not, however, to be supposed that the triumphs of the American people in these matters have been achieved without effort. Much testimony is borne to the fact that in the conditions of organization and administration, in their dealings with labor, in the confidence and enterprise with which they have embarked on industrial operations of great magnitude, in the efforts made to adapt themselves to new conditions, in the eagerness with which they have endeavored to create new demands both at home and abroad, and in the care and attention given to the successful cultivation of foreign markets, the American people have labored strenuously for many years, until labor, ingenuity and enterprise have become their most distinguishing characteristics. When one has appreciated all that the Americans have done for themselves, it is neither natural nor reasonable to grudge them the success which has attended their labors."

Commercial Intelligence presents the following picture of the relative growth of the iron and steel industry in the United States and the principal countries of the world.

Production of pig iron in the United States, United Kingdom, Germany and all other countries, in thousands of gross tons:

Year.	United States. 1,000 tons.	United Kingdom. 1,000 tons.	Germany. 1,000 tons.	All other Countries 1,000 tons.
1865.....	832	4,819	760	2,839
1870.....	1,668	5,964	1,369	2,902
1875.....	2,024	6,365	1,997	3,510
1880.....	3,835	7,749	2,686	3,201
1885.....	4,045	7,415	3,629	4,439
1890.....	9,203	7,904	4,585	5,738
1895.....	9,446	7,703	5,379	6,376
1900.....	13,789	8,960	8,386	9,265
1901.....	*15,878	7,750	*7,737	9,042

CHICAGO MACHINERY MARKET.

The Pittsburgh representative of a Western builder of engines came to Chicago one day last week with orders in his pocket for $300,000 worth of engines and with inquiries for $1,800,000 more. The inquiries were so heavy that much of the business could not be handled, deliveries being impossible. Most of the power desired was blowing engines, and it was all wanted in a hurry. If six instead of from ten to eighteen months delivery could be made on this class of work and on other heavy machinery in proportion, the producing capacity of the iron furnaces and steel mills would undergo a notable expansion in the near future. The Birmingham (Ala.) district also is calling for many blowing engines.

The Frost Manufacturing Company is finding demand west of the Mississippi River for boilers and automatic engines just now relatively more active than that east of the river and in what might be called Western territory. The demand for boilers, moreover, is relatively better than for engines, especially in Chicago, where direct-connected work is common. The Frost works are rushed and there is difficulty in keeping up with the orders. In the extreme West there is now an active demand for pumping engines, mostly centrifugal, for irrigation purposes. It is said that that field will show wonderful increases in the future, indications pointing to a much heavier demand later. Mining operations also are calling for a large amount of machinery in the West.

The Allis-Chalmers Company have sold two 4,000 horse-power engines for electric street railway installation in New Orleans; a large pumping station for the San Antonio (Tex.) water works; also a triple expansion pumping engine for the Omaha water works, a duplicate of the highest power pumping engine previously constructed. While its capacity is only 20,000,000, the pumping is against a head of 310 feet and power required is three times that for the same capacity at the Chicago water works.

The Kalamazoo (Mich.) Paper Company, John V. Wallace, New York, engineer has let the contract for one 800 horse-power, one 450 horse-power and two 300 horse-power engines to the Nordberg Manufacturing Company, Milwaukee, and for boilers of 1,500 horse-power to Wickes Bros. The Chicago, Milwaukee & St. Paul road has let contracts for boilers of 1,200 horse-power for new shops at West Milwaukee.

The market for both boilers and engines in the West is satisfactory. It is said that competition in water-tube boilers is becoming keener because of the number of new manufacturers, but there is no decrease in the amount of business offered. Some business has been closed up in the last few days that had been on the market for two years. Many important jobs are still pending.

*Iron and Steel Association figures.

Quotations.

NEW YORK, Monday, July 28.

Attention for the most part in the pig iron market is centered in delivery of iron for next year. Northern furnaces have not yet opened their books for 1903 and the Southern furnaces which have report their business to be above expectations. Prices for spot iron continue to be in the hands of the seller, and wherever any is offering good premiums are being paid. Foreign irons, especially Scotch brands, are being sought by melters who have requirements to meet this year. New York quotations for delivery this year are as follows:

Northern:

No. 1 X	$23 50 @ $25 00
No. 2 X	22 75 @ 23 50
No. 2 plain	22 25 @ 22 50

Southern:

No. 1 Foundry	22 00 @ 23 00
No. 2 Foundry	21 75 @ 22 50
No. 3 Foundry	21 25 @ 22 75
No. 4 Foundry	20 75 @ 21 25

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93c. upward in carload lots. Smaller quantities from store, 2.15 @ 2.20c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 12⅛ @ 12¼c.; electrolytic and casting, 11⅞ @ 12c.

Pig Tin—In 5- and 10-ton lots, f. o. b. New York, 28½ @ 28¾c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—5¼ @ 5⅜c., New York.

Antimony—Cookson's, 10 @ 10¼c.; Hallett's and U. S., 8 @ 8¼c.

Lard Oil—Prime City, 84 @ 86c., according to brand and quantity ranging from one barrel up to large lots.

Manufacturers.

Oakland, Ill., is preparing to install waterworks.

The Portland Woolen Mill, at Sellwood, Oregon, will enlarge its plant.

The Westboro (Mass.) Weaving Company will build a mill at that place.

A 50-acre tract of land has been purchased for new cotton mills at Magnolia, Mass.

The Rich Knitting Company will build a $35,000 factory building at Cleveland, O.

A. Corbin, of Gouverneur, N. Y., has discovered garnet there and will erect a mill.

The Vandegrift Coupling Company has removed its works from Indianapolis to Evansville, Ind.

Frank Miller will erect a three-story addition to his lumber, sash and door mill at Bridgeport, Conn.

W. C. Vereen has been elected president of the Fculan cotton mills, which are to be erected at Tifton, Ga.

The Malleable Iron Fitting Company, of Branford, Conn., is to erect a new factory, 300x110 feet, this fall.

Hartford (Conn.) Machine Screw Company will build a factory building, 98x21 4-10 feet, at No. 476 Capitol avenue.

Harry B. Shoemaker & Co., of Philadelphia, Pa., are taking estimates on a factory for the Branson Machine Company.

Ground has been broken for a new factory to manufacture "air burners" at Aurora, Ill., by the Doyle Air Burner Company.

The Lafayette Worsted Company, of Woonsocket, R. I., whose mill has been running night and day, is enlarging its plant.

The Barber Asphalt Company will close a lease or buy a site for a $50,000 factory in Manufacturers' addition, Des Moines, Ia.

W. D. Byron & Sons have commenced the construction of a new and large plant for the manufacture of patent leather at Williamsport, Md.

The erection of a new roundhouse near Todd's Cut (near Wilmington, Del.) has been

commenced by the Pennsylvania Railroad Company.

It is hoped that the new plant of the Webster, Camp & Lane Company, in South Akron, O., will be ready for occupany before November.

John A. Rigg, of Reading, Pa., is interested in a company which will probably build a new electric power plant there at a cost of $1,000,000.

The Sanquoit Silk Mills will be erected in Philadelphia, Pa. The mills will be four stories, 113x229 feet, with one-story engine and boiler house.

The boiler manufacturing concern of McIlvain & Spiegel has submitted plans for extensive alterations of the plant on Lawrence street, Cincinnati, O.

Work is being rapidly pushed in the reconstruction of the Emmert Manufacturing Company's shops at Waynesboro, Pa., recently destroyed by a tornado.

W. G. Tice, who has been superintendent of the Alpha Mills, Jonesville, S. C., will resign his office soon and go to Texas, where he will build a yarn mill.

Plans are being made for a $100,000 manufacturing plant for the Smeeth Copper & Bronze Company, at Twenty-second street and Western avenue, Chicago, Ill.

The Johnston & Jennings Company will build a manufacturing plant between Thirty-seventh and Thirty-eighth streets, Chicago, Ill., the cost to be about $70,000.

There is considerable probability that the T. M. Sinclair Packing Company will increase its Peoria (Ill.) plant by erecting new buildings and installing new machinery.

A contract for a foundry building for Henry Irwin, at 133 North Twenty-second street, Philadelphia, Pa., has been let. It will be of brick and steel, 20x90 feet.

D. E. Postel will make plans for a $100,000 manufacturing plant for the Smeeth Copper & Bronze Company at Twenty-second street and Western avenue, Chicago, Ill.

Bids are being received from builders for the erection of a machine shop for the Standard Roller Bearing Company, at Forty-ninth street and Merion avenue, Philadelphia, Pa.

Builders are estimating on a wood-working shop addition to the plant of Fayette R. Plumb, Frankford, Pa. It will be two stories high, 62 feet 10 inches by 98 feet 10 inches in dimensions.

Plans are about completed for the new four-story building to be erected by the Rumely Manufacturing Company, Des Moines, Ia. The new building will be 132 feet square, four stories high.

William Sellers & Co., of Philadelphia, Pa., have filed plans with the Bureau of Inspection for a brick foundry and flask shop, to measure 80x117 feet, at Sixteenth and Buttonwood streets.

R. D. Haven, secretary of the West End Business Men's Club of Duluth, Minn., is reported as saying that a co-operative machine shop will be opened there in old Doherty foundry property.

Frank Myers, of Honesdale, Pa., has decided to erect a factory. It will be built of brick, with two stories and basement, possibly three stories, about 34x70 feet. It is to be a knitting mill.

Charles Coulter will build for Charles Miller a factory building at 3727 and 3729 Filbert street, Philadelphia, Pa. It will be a two-story and basement structure, of brick, to measure 37x110 feet.

The Upton Machine Co., builder of automobiles, has purchased the North Shore Lumber Company's plant, at Beverly, Mass., and will remove at once, doubling its capacity and employing 250 hands.

The Pennsylvania Railroad Company officially announces its intention to build a large plant for car repairs at Altoona, at a cost of $200,000. A similar plant will later be built in Allegheny.

At Cadillac, Mich., Williams Brothers are erecting a factory for the manufacture of last-blocks, billiard cues and ten-pins. It is said the factory will be the largest of the kind in the United States.

The Nilson Machine Company, of Bridgeport, Conn., has drawn plans for the new factory which it is to erect on a site recently purchased. The factory will be of brick and two stories high, 40x150 feet.

Charles B. King has leased to Stromberg, Allen & Co. the lot, 50x105 feet, at Nos. 300-302 Clark street, south of Van Buren, Chicago, Ill., and will erect a six-story mill-construction building to cost $40,000.

The Hamilton Bridge Works, Hamilton, Ont., ship and bridge builders and makers of structural iron work, are doubling the capacity of their plant. One of the additions will be a steel frame building, 200 feet square.

As soon as the insurance policies are satisfactorily adjusted the hat manufacturing firm of F. Berg & Co., of Orange Valley, N. J., will begin to rebuild its factory which was destroyed by fire on the night of June 19 last.

The American Can Company will erect a branch factory on 10 acres of land at Paulsboro, N. J., along Mantua creek. Work will be begun as soon as material can be gotten together. Employment will be given to 100 men.

The Handian-Buck Manufacturing Company, St. Louis, Mo., has acquired all the assets of the M. M. Buck Manufacturing Company, and will hereafter conduct the business formerly carried on by the old concern.

Robert C. Berlin is taking figures on a $25,000 factory to be built on the north side of Twenty-fourth street, 130 feet west of Wabash avenue, Chicago, Ill., for George F. Moore. It will be three story, 78x170 feet, of mill construction.

The Savage & Tyler Mill Company is moving into its new works in Knoxville, Tenn. The plant is described as one of the finest in the South. There is an aggregate of 20,000 square feet of floor space.

The Wilkinson Shear Company, of Reading, Pa., contemplates erecting a new plant, extending the business and adding to the line of production certain specialties in the cutlery line with which it has been experimenting during the past year.

A contract has been signed between the Commercial Club, of Centralia, Wash., and John P. Symons, of Muskegon, Mich., by which the latter agrees to establish a $20,000 foundry plant and repair shop, and the former to provide the necessary site.

A new flour mill of 500 barrels capacity, and which will cost $50,000, will be built at Wellington, Kan. The officers of the company are C. E. Hitchcock, president; H. F. Smith, vice-president; Ed. Rothwell, secretary, and Walter Moody, treasurer.

A machine shop addition to the plant of Morse, Williams & Co., in Frankford avenue, below Girard avenue, Philadelphia, Pa., will be put up. It will be a three story and basement brick structure, of steel frame construction, to measure 110½x63½ feet.

It is rumored that a company of Philadelphia and New York capitalists has been formed to develop the cement beds near Larrys Creek, Pa. A plant may be erected that will cost $500,000. C. E. Sprout, of Williamsport, Pa., is interested in the project.

Fremont Turner, a contractor of water towers, is completing a new foundry plant at East Seventh and Raccoon streets, Des Moines, Ia., and intends to engage in the manufacture of iron staircases, stand-pipes, tank frames and a general line of foundry work.

A new manufacturing concern is negotiating with A. R. Thompson, Cleveland, O., for the purchase of some river front property. If the deal is consumated the building now on the premises will be added to and remodeled and an entire new power plant installed.

The last factory which has been located on Pleasant street, Malden, Mass., for more than half a century is to be moved to Eastern avenue, where the company is to erect a building, 42x150 feet. There will also be a building for heating, 22x170 feet, and a dryhouse, 40x120 feet.

The W. F. & John Barnes Company is contemplating building an addition to its manufacturing plant in South Water street, Rockford, Ill. The plan is to build on 96 feet to the north, the structure to be the same style as the other buildings of the plant and to be used for storage.

Col. S. G. Gillespie has purchased the plant of the Litchfield (Ill.) Car Company, including engine, boilers, tracks and sheds, and will convert same into a factory for the manufacture of "briquets" from bituminous coal slack, which will be used as a substitute for hard or anthracite coal.

The Stewart Iron Works, Third and Culvert streets, Cincinnati, O., plans erecting a mammoth plant near Waverly Avenue, Norwood, to manufacture architectural and structural iron. It is said the Norwood concern is to be capitalized at $500,000 and will employ 200 or 300 men.

Charles D. Fuller, of Kalamazoo, Mich., has purchased about 75,000 acres of timber land near Murphy, N. C., for development. He will establish large manufacturing plants, including one to convert balsam into paper pulp, and erect flume to carry lumber from the mountains to the mills.

The Malleable Iron Fittings Company, of Branford, Conn., is to erect a large new building this summer and fall. It will be 200 by 118 feet and will be used as an annealing shop. The company has just awarded the contract for its erection to the H. Wales Lines Company, of Meriden, Conn.

A new industry, to be known as the Cortland Implement Company, has been organized in Cortland, N. Y. The company, which is capitalized at $50,000, has purchased the old Howe ventilating stove plant. The buildings will be completely overhauled and the plant will be equipped with machinery.

The Toledo (Ohio) Tube Company has closed a contract with the Toledo Railway & Terminal Company and will remove its factory, located at present in Auburndale, to a point on the Terminal belt. A new factory will be erected and the facilities for manufacturing tubing will be greatly increased.

An addition to the hosiery mill of E. Sutro & Son, Philadelphia, Pa., will be built. It will be a four-story structure, of brick, on the slow-burning mill construction plan, with a brick tower fire-escape, and will measure 40x144 feet. An additional story will also be added to the present two-story mill building.

The Iola (Mo.) Portland Cement Company has announced its intention of enlarging its plant. The plant as it now stands cost $1,000,000 and has a capacity of 3,000 barrels a day, employing 400 men. The addition will cost $800,000, increase the capacity to 5,000 barrels daily and the number of employees to 650.

Wm. Bellingham, of Montreal, has submitted a proposition to the Town Council of Brockville, P. Q., to establish a malleable

iron and steel works in Brockville in consideration of a bonus of $50,000, exemption from taxation, etc. The concern will employ 300 hands and will install a valuable plant.

The American Can Company will erect a large mill at Maywood, near Chicago, for the manufacture of tin plate. The can company at present uses a large amount of the product of the tin plate company, and it is claimed can manufacture tin plate 50 cents a box cheaper than the tin plate company through patents which it controls.

Charles G. Turner, of Grand Rapids, Mich., and several other Michigan men are interested in the organization of a company in Chicago for the manufacture of slot vending machines, to be known as the Sears Automatic Vending Machine Company. The company will have a capital of $100,000, and the plant will be located in Chicago.

It is expected that the new plant of the Delaware Button Company in South Wilmington, Del., will be ready to begin operations in a short time. The officers of the company expected to be ready some time ago, but some difficulties arose. These have now been overcome and the factory will soon start with a number of employees.

Manager A. H. Green, of the Solvay Process Company, Louis Blitz and other Detroiters are about to form a company to manufacture glass. The factory will be situated in Delray. The factory will use a part of the product of the Solvay Process Company in the making of the glass, and it is said the Solvay Company will have an interest in the company.

The former Mahoning valley iron men now located at Seattle, Wash., are heavily interested in a $300,000 plant to be erected at Ballard, Wash., one of the suburbs of Seattle. They are William Pigott, formerly with the Andrews & Hitchcock Iron Company and a former resident of Hubbard, and W. D. Hofius, who for many years operated blast furnaces in the valleys.

After August 1 The Automobile & Cycle Parts Company, of Cleveland, Ohio, will transact business under the name of The Federal Manufacturing Company. This change of title will not in any manner affect the management of the company or the business of its factories. The products of the company's factories are so diverse that a comprehensive firm name had become a necessity.

An engine works is being built by the H. N. Strait Manufacturing Company at Adams street and Shawnee avenue, Kansas City, Mo. The plant will be composed of two large buildings. The factory building will be 212x100 feet, and the machine shop, 212x80 feet. The plant will employ 500 men. The plant will manufacture Corliss engines. All the machinery will be operated by electricity.

New Orleans is to have a plant for the refining of cotton seed oil on a large scale. Its daily capacity will be 1,000 to 1,200 barrels. Work on the refinery will be begun shortly and rushed to completion. Captain A. P. Sauer, well known in Houston, Tex., where for many years he has had charge of the affairs of the Southern Cotton Oil Company, will be president of the new corporation.

The Brylgon foundry is to be moved from Reading, Pa. The decision has been made after the firm had given up the search for a suitable site to erect a larger plant. The place where it will be moved to has not yet been decided on. The possibilities are in favor, however, of Philadelphia. Plans are now being made for a new plant, larger than the one in use, and built on very modern plans.

The erection of a new distillery in Toronto, Ontario, is contemplated for the purpose of converting the residue from beet root sugar and other refineries into alcohol for use in the arts, and generally for non-potable purposes. It is understood that Messrs. Gooderham & Worts and Mr. F. H. Walker, of Messrs. Hiram Walker & Sons, with several other capitalists, are interested in this company, and that they will erect an entirely new plant.

The New York & St. Louis Mining & Manufacturing Company is preparing to let contracts for its smelting and fertilizer manufacturing plant, which, according to the plans adopted, will, when completed, cover 20 acres of ground. The site is near Madison, Ill., along the terminal belt line. These buildings and equipment will cost $150,000 to $175,000, it is estimated. The company's main offices are in the Roe building, Broadway and Pine streets, St. Louis, Mo.

Ground has been broken for the new factory of the Greenfield Automatic Machine Company, at Greenfield, Mass. The main portion is to be 120 feet square, with a wing to the west side, 35x40. It is to be of brick and one story high. The main building will be for the general manufacturing and the wing will be used for the boiler and engine and case-hardening departments. On the north side the outside wall will be so made that an addition can be readily built on.

The Board of Directors of the Commercial Club of Indianapolis, Ind., has indorsed the action of the Factory Association in deciding to return to purchasers of lots in the factory addition the amount that had been paid on them. Over $17,000 will be returned to those who had paid in full or had only partially paid for the lots. This action was taken because a clear title could not be obtained on the land. The Factory Association has other sites in view, but will take no action at present.

The United States Steel Corporation will build its $10,000,000 tube plant in McKeesport, Pa. The site will occupy a total area of fifteen blocks. This announcement is taken as an indication that the scheme to build a big tube plant at Conneaut has been abandoned. It is probable, however, that he proposed works at Lorain, O., will be built, at a cost of about $10,000,000, and that all of the tube plants of the big steel corporation will be concentrated at McKeesport and Lorain.

The J. A. Fay & Egan Company, of Cincinnati, O., has completed negotiations for the purchase of 93 acres of land north of the Rose Hill subdivision of Avondale and south of the Baltimore & Ohio tracks on the Paddock road, and will in the course of time locate its factory on the tract. In regard to the matter Thomas P. Egan, president of the company, said that while the property had been purchased, it was not intended to remove the factory for some time, and it might be a year or even two years before the present factory is abandoned.

The Phoenix Iron Works purchased the half block on East Third street, Portland, Ore., and will proceed with the erection of buildings suitable for machine shops. There will be three buildings. Machine and boiler house will be two stories, 70x100; foundry, 60x80, and pattern shop, 30x50. New machinery will be ordered, and the works will be up to date in all respects. Separate motors will be used for the machines. Samuel Morrow is president, and Fritz Wolff, formerly head of the Wolff & Zwicker plant, is vice-president and manager of the company.

The Plainfield, N. J., *Press* says: "Among some of the larger buildings which are now in process of construction are the addition to the Scott Printing Press Works, additions to the Safe Works, extensions at the Pond Tool Works and several structures in the center of the city, including a three-story brick on Somerset street. Frame structures are to be seen going up everywhere, and especially in the West End, where many residences are partially completed. The larger part of them are being built by mechanics who are taking advantage of building and loan associations to have homes of their own."

Plans for the enlargement of the Chicago paint plant of the Sherwin-Williams Company at Pullman have been completed in the general offices at Cleveland. The plant is located at One Hundred and Fifteenth street and will consist of a three-story structure, 450x63 feet, for dry color and filling departments, and a three-story structure, 100x150 feet, for the office and shipping department. These two buildings will be erected at once and others are to follow, among them a gymnasium, yacht clubhouse and restaurant for the use of the employees. The entire improvement will involve an expenditure of about $300,000.

The *Mercury*, of Newport, R. I., says the Builders' Iron Foundry has recently purchased 16 acres of land in Bristol, and intends to move its entire plant to that place in a short time. The town voted last spring to exempt the foundry from taxation for ten years if they construct their works as expected. The land purchased is a well-adapted site for manufacturing purposes. It is situated west of the tracks of the Consolidated Railroad, and off shore there is a good depth of water where vessels could come into a wharf, if it is built there, and discharge their cargoes.

A new corporation, the Garland Nut & Rivet Company, will begin the erection of a new plant in West Pittsburgh, the cost of which will be in the neighborhood of $100,000. The plant will be a brick structure, 700x75 feet. Most of the stock is owned by the stockholders in the Garland chain works at Rankin, and the rivet department now conducted in connection with it will be removed to the new plant. Besides cold and hot rivets of all sizes, the company will manufacture hot and cold, press, blank and tap nuts, the patents for all of which are owned by it. The structure and machinery will be all of the most modern kind, and a complete power plant costing about $10,000 will be installed. The new industry at the outset will employ 200 men.

Plans are being prepared by the Edgar S. Low Company, of Pittsburgh, Pa., for the building of a large car works in Everson, Pa. The new works will be operated mainly to supply car equipment for contracting concerns and railroad building, but it is said that the company will also be prepared to supply standard railroad cars of the wooden type to railroads. There are to be three main buildings to start with. One will be 100x60 feet and the other two about the same size. Steel frames and brick facings will be used in all of them. A power-house will be put up in an isolated position and far removed from the other structures, so that the least danger from fire will be experienced. Contracts for the buildings will be let within a few weeks. There are also to be a number of extensive contracts for machinery and equipment awarded during the next few months, all of which will have to be completed before the early portion of 1903.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.
Punches & dies. Wal.M.Wks., Waltham, Mass.
Caliper cat. free. E. G. Smith, Columbia, Pa.
Patterns and models. 19 Thames st., N. Y.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Wanted—The address of a shop fitted for fine work, such as typewriters. Box 698, AMERICAN MACHINIST.

Wanted—An automatic gear cutter to cut not less than 24 in. in diameter, 4 diametrical pitch. Address F. X. Hooper, Glenarm, Md.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Gear and milling cutters, adjustable reamers and special tools; vertical milliers, cutter and surface grinder and shears, catalog of small tools free. R. M. Clough, Tolland, Ct.

For Sale—Machine shop and foundry with a well-established business, long standing and good reputation; located in a city of 30,000 inhabitants; best of shipping facilities; good reason for selling. Address F. M., care A. M.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

$5,000 capital for new line of small machinery; one of the products includes much screw machine work, on 2-inch stock; fine field, little worked, for a specialty along this line; has passed the experimental stage and desirous of locating in an Eastern city. Box 708, A. M.

For Sale—1 50x36x24 in. planer, 2 400-light dynamos, 1 14x36 in. Hamilton Corliss engine, 1 9x12 in. Chandler & Taylor slide valve engine, 1 9x10 in. Chandler & Taylor automatic engine, 1 direct-connected steam air compressor, 12x12, Ingersoll-Sergeant; 1 10-ton, with 3-ton auxiliary, Chisholm & Moore air crane, 30 ft. span; 1 jib crane, 10 tons. All of the above can be seen in operation at Henry Vogt Machine Co., Louisville, Ky.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Wanted—Position, toolmaking or fine work. Box 711, AMERICAN MACHINIST.

By a practical man, charge of fine manufacturing. Box 693, AMERICAN MACHINIST.

Factory superintendent, varied, up-to-date experience, desires change. Box 707, AM. M.

Experienced mechanical draftsman wishes position near New York city. Box 706, A. M.

Foreman, wide experience, open for engagement. T. J. Keller, 286 E. Huron st., Chicago.

Mechanical draftsman, quick tracer, desires position as assistant. Box 685, AMER. MACH.

First-class metal pattern maker (understands molding machine) wants position. Box 681, AMERICAN MACHINIST.

First-class mechanical draftsman wants to change position; New York or Brooklyn. Box 710, AMERICAN MACHINIST.

Wanted—Position as foundry foreman. Address "Foundry," care James W. See, Consulting Engineer, Hamilton, Ohio.

First-class, live foundry foreman; New York or vicinity; machine work; references. Box 699, AMERICAN MACHINIST.

Mechanical draftsman, 12 years' shop and office experience on tools and electrical machinery, wants position. Box 703, AM. M.

An M. E. graduate, with 3 years' practical experience in shop and drafting room, desires position in or near New York. Box 705, AMERICAN MACHINIST.

Mechanical engineer, graduate 1902, desires permanent position, with opportunity for advancement; best of references furnished. Address Box 700, AMERICAN MACHINIST.

Tool designer wants position; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

Practical mechanic and factory superintendent would like to hear from parties wanting a man in that capacity; can give good references. Box 655, AMER. MACHINIST.

Machine shop foreman or superintendent; extensive experience, practical and reliable; 16 years' practice, 7 years as general foreman; A1 reference. Address "Mechanic," Box 691, AMERICAN MACHINIST.

Mechanical engineer, 29, graduate of Stevens Institute, 6 years' experience, machine shop, drafting room and as outside representative, wishes change of position. Address Box 704, AMERICAN MACHINIST.

$2,000 factory manager, age 32, practical and technical, open November 1; interchangeable parts a specialty; automobiles, gasoline and steam engines, dynamos, electrical parts. Address M. L., care AMERICAN MACHINIST.

Mechanical engineer and expert designer desires change; a technical graduate with 10 years' experience in the design and installation of power plants, power transmission, excavating, conveying and general heavy machinery; have held position of chief draftsman with shop supervision. Address Box 697, AMERICAN MACHINIST.

Help Wanted.

Wanted.—First-class patternmakers wanted at Reeves Engine Co., Trenton, N. J.

Wanted—First-class, all-round machinists. Bullock Electric Mfg. Co., Cincinnati, Ohio.

Wanted—Half-dozen good machinery molders. Southern Foundry & Machine Co., Knoxville, Tenn.

Wanted—Men in large cities to take orders for machine tools. Cochrane-Bly machine Works, Rochester, N. Y.

Wanted—A first-class wood pattern maker; ten hours day; wages 30c. per hour. Address Wm. E. Hill & Co., Kalamazoo, Mich.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—Three or four first-class machinists, also one patternmaker. Address Morse Twist Drill & Machine Co., New Bedford, Mass.

Wanted—Ten good patternmakers at once; new shop and equipments; good wages. The Balkwill Pattern Works, 970 Hamilton st., Cleveland, Ohio.

Wanted—A number of first-class patternmakers at once; best wages paid; new shop and machinery. The Balkwil Pattern Works, 970 Hamilton st., Cleveland, Ohio.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—A mechanical draftsman with experience on machine tools and special machinery; state wages expected. "Worcester County," care AMERICAN MACHINIST.

Wanted—Mechanical engineer and draftsman, capable of designing rolling mill machinery. Answer, stating age, experience and salary desired, Box 702, AMERICAN MACHINIST.

Wanted—A competent foreman to take full charge of sheet metal drawing, forming and punching department; state wages expected and experience. Address Box 680, AM. M.

Wanted.—Dynamo manufacturer requires machine shop foreman; state age, salary, experience and references; good opening for a progressive man. Address Box 153, Erie, Pa.

Wanted—First-class toolmakers, experienced on punch and die work; must also be first-class men on general work; state experience, also wages expected. Richmond Electric Company, Richmond, Va.

Wanted—Three first-class machinists, accustomed to tool and jig work; permanent position for suitable man. Address, stating age, experience and wages expected, H. W. H., care AMERICAN MACHINIST.

Wanted—Foreman in machine shop in New England, manufacturing freight and passenger elevators and doing general machine work; employs 40 men. Address, stating age, experience, etc., Box 690, AMER. MACHINIST.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—First-class foreman for brass foundry; must be progressive and familiar with modern methods; permanent position for good man. Address, stating experience, references and wages expected, A. B. C., Room 29, Potter Building, New York City.

Wanted—First-class detail draftsman, experienced on machine tool work; factory 100 miles from Chicago; a first-class man who can command good pay only wanted; married man looking for steady position preferred. Address Box 664, AMER. MACH.

Wanted—A manager for machinery and supply company in Canada; must fully understand the business; a good buyer and seller, able to make the business hum; a good opening for the right kind of man. State experience to Box 701, AMERICAN MACHINIST.

Shop in Philadelphia, manufacturing a light specialty, employing 30 hands, wants a good mechanic and toolmaker; a man of intelligence and character not afraid of work can find a chance for advancement and a permanent place in a growing business. Box 709, AMERICAN MACHINIST.

Designer of automobiles wanted in Philadelphia to take charge of drafting department in automobile works; must have a theoretical as well as practical experience in mathematics and gas engine construction; give age, present occupation and salary expected. Box 687, AMERICAN MACHINIST.

Wanted—As instructor in patternmaking in an Eastern school of engineering, an intelligent, young, energetic patternmaker with exceptional knowledge and skill at his trade; good salary. Apply, stating age, nationality, education and experience in detail, "Instructor in Patternmaking," care AMER. MACH.

Wanted—By Blees Military Academy, Macon, Missouri, an instructor in manual training; topics, carpentry, woodturning, forging, chipping, filing, mechanical drawing, machine drawing; the instructor must be unmarried, have successful teaching experience and college education; salary will not exceed $1,000.

Wanted—A young or middle-aged man for position as foreman in a machine shop doing general work; must be a good mechanic, acquainted with modern methods and have good executive ability; a person with a knowledge of modern paper making machinery would be preferred. Address, giving age and experience, P. B. Taylor, 122 Market st., Newark, N. J.

Machinist Wanted.—To keep pace with our rapid growth we need an additional number of experienced machinists; we want steady men of good habits, looking for permanent positions; school, home and health advantages of Madison are unsurpassed; write immediately for particulars; state age, experience, etc. Northern Electrical Mfg. Co., Madison, Wis.

Paint and assembling foreman wanted; a competent and experienced foreman for painting and assembling department of an agricultural implement factory; none but thoroughly experienced need apply; must be able to devise plans and methods of getting work out in excellent shape and at the least possible cost; give age, reference and salary expected. Address Box 695, AMER. MACH.

We wish to employ at once first-class mechanics, experienced in operating the Gisholt turret lathe, Jones & Lamson turret lathe and the American Tool & Machine Company's improved brass lathe; also a man to take charge of screw machine and chucking lathe department, capable of designing and equipping the machines for special work, and a planer hand on medium heavy work. De Laval Steam Turbine Co., Trenton, N. J.

Wanted—Assistant to the manager, an energetic young man who is familiar with air compressors or gas engines; one who can take charge of office, prepare estimates on complete plants and assist generally in the management of a strictly modern shop; state fully experience, nationality, age, whether married or single and probable salary expected; this is a permanent and desirable position to the right man. Address The Gray-Blaisdell Company, Bradford, Pa.

Wanted.—Machinists, toolmakers, draftsmen, do you want to increase your salary? They all say that Saunders' enlarged edition "Hand Book Practical Mechanics" exactly fills the bill for valuable shop kinks, rules, etc., figured out by simple arithmetic and drawings; also most complete reference tables in existence, many taken from note books of best mechanics in the country. Pocket size. Price, post paid, only $1, cloth; $1.25 leather. Agents wanted. Book sells itself. Big money. C. H. Saunders, 216 Purchase st., Boston, Mass.

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Abrasive Materials

Abrasive Material Co., Phila., Pa.
Carborundum Co., Niagara Falls, N. Y.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.

Arbor Press

Barnes Co., W. F. & John., Rockford, Ill.
Bartlett, E. E., Boston, Mass.

Ball Bearings

See Roller Bearings.

Balls, Steel

Automobile & Cycle Parts Co., Cleveland, O.
Grant Tool Works, Franklin, Pa.

Bars, Boring

Cleveland Twist Drill Co., Cleveland, O.
Underwood & Co., H. B., Philadelphia, Pa.

Barrels, Steel

Cleveland Wire Spring Co., Cleveland, O.

Bearing Metal

Phosphor Bronze Smelting Co., Philadelphia, Pa.

Belt Dressing

Dixon Crucible Co., Jos., Jersey City, N. J.
Houghton & Co., E. F., Philadelphia, Pa.

Belt Lacing Machines

Diamond Drill & Mach. Co., Birdsboro, Pa.

Belting, Leather

Shultz Belting Co., St. Louis, Mo.

Bending Machines, Hydraulic

Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Bending Machines, Power

Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Reade Mchry Co., Cleveland, O.

Blocks and Tackles

See Hoists, Hand.

Blowers

Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.

Boilers

Struthers, Wells & Co., Warren, Pa.

Bolt and Nut Machinery

Acme Mchry. Co., Cleveland, O.
Detrick & Harvey Mach. Co., Baltimore, Md.
Pratt & Whitney Co., Hartford, Conn.
Wells Bros. Co., Greenfield, Mass.

Books, Mechanical

Baird & Co., Henry Carey, Philadelphia, Pa.
Henley & Co., N. W., New York.

Boring and Drilling Machines, Horizontal
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., N. Y. City.
Betts Mach. Co., Wilmington, Del.
Binsse Mach. Co., Newark, N. J.
Dallett & Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fosdick Mach. Tool Co., Cincinnati, O.
Franklin Mach. Wks., Phila., Pa.
McCabe, J. J., New York.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Boring and Turning Mills
American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Calculating Machines
Barth, Carl G., Swarthmore, Pa.

Carborundum
See Grinding.

Castings, Aluminum and Bronze
Christensen Engineering Co., Milwaukee, Wis.

Castings, Brass
Christensen Engr. Co., Milwaukee, Wis.
Nolte Brass Co., Springfield, O.

Castings, Brass and Bronze
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Iron
Taunton Loco. Mfg. Co., Taunton, Mass.

Castings, Motor
Graves Motor Mfg. Co., St. Paul, Minn.

Castings, Steel
Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Newark, N. J.
U. S. Steel Co., Everett, Mass.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Centering Machines
Bement, Miles & Co., New York.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Chains, Driving
Automobile & Cycle Parts Co., Cleveland, O.
Boston Gear Works, Boston, Mass.
Bridgeport Chain Co., Bridgeport, Conn.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Whitney Mfg. Co., Hartford, Ct.

Chucking Machines
Cleveland Mach. Screw Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Goodell-Pratt Co., Greenfield, Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankford, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
The E. Horton & Son Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Coil Clutch Mfg. Co., New York.
Faneuil Watch Tool Co., Boston, Mass.
Jacobson Mach. Mfg. Co., Warren, Pa.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

Codes
Lieber Code Co., New York.

Compressors, Air
Blanchard Mach. Co., Boston, Mass.
Chicago Pneumatic Tool Co., Chicago, Ill.
Christensen Engineering Co., Milwaukee, Wis.
Clayton Air Compressor Works, New York.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Gray-Blaisdell Co., Bradford, Pa.
Ingersoll-Sergeant Drill Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Rand Drill Co., New York.

Consulting Engineer
Thompson, Hugh L., Waterbury, Conn.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.

Correspondence Schools
See Schools, Correspondence.

Countershafts
Builders' Iron Fdry., Provi., R. I.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Reeves Pulley Co., Columbus, Ind.
Wheaton Mach. Co., Boston, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.

Couplings, Shaft
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.

Cranes
Brown Hoisting Mach. Co., N. Y. City.
Case Mfg. Co., Columbus, Ohio.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.

Cranes—*Continued*
Curtis & Co. Mfg. Co., St. Louis, Mo.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutting off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Drafting Machine
Universal Drafting Mach. Co., Cleveland, O.

Drawing Boards and Tables
Rich, J. & G., Philadelphia, Pa.

Drawing Instruments
Altenedor & Sons, Theo., Philadelphia, Pa.
Keuffel & Esser Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Dwight Slate Mach. Co., Hartford, Conn.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.

Drills, Boiler
Aurora Tool Works, Aurora, Ind.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Radial
Gang Co., Wm. E., Cincinnati, O.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Drills, Upright
Aurora Tool Works, Aurora, Ind.
Blaisdell & Co., P., Worcester, Mass.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrically-Driven Tools.
Clark, Jr., & Co., Jas., Louisville, Ky.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Backus Water Motor Co., Newark, N. J.
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Struthers, Wells & Co., Warren, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Eye Shield
McDougal, W. H., Charleston, W. Va.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.
Troy File Works, Troy, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
New York Gear Works, Brooklyn, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Browning Mfg. Co., Milwaukee, Wis.
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Modern Tool Co., Erie, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Safety Emery Wheel Co., Springfield, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.

Grindstones
Cleveland Stone Co., Cleveland, O.
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Enginering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fay & Scott, Dexter, Me.
Fairbanks Machine Tool Co., Springfield, O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply So., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rowbottom Mach. Co., Waterbury, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Works, Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Works, Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Straley, Hasbrouck & Schloeder, New York.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Gobeille Pattern Co., Cleveland, O.

Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Planers
American Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.

Planers—*Continued*
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Presses, Hand
Elmes Engineering Wks., Chas. F., Chicago, Ill.

Presses, Hydraulic
Bement, Miles & Co., New York.
Elmes Engineering Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Elmes Engineering Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting.
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
State College of Kentucky, Lexington, Ky.
Purdue University, Lafayette, Ind.
Worcester Polytechnic Institute, Worcester, Mass.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Dawson, John H., Chicago, Ill.
Fairbanks Co., New York.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Standard Roller Bearing Co., Philadelphia, Pa.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.
York Mchry. Co., S. M., Cleveland, O.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Separators, Oil
Springfield Separator Co., Springfield, Vt.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New Haven.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Smith & Mills, Cincinnati, O.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
Herman Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriache & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Foster, Walter H., New York.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Unions
Nolte Brass Co., Springfield, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Hollands Mfg. Co., Erie, Pa.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automobile Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Molding Bosses on Castings.

BY JOHN M. RICHARDSON.

Bosses in different shapes and under different conditions are called by a number of different names, such as boss, hub, ear, lug, and so on. Nothing is more common than to be confronted with these projections with the innocent little names of a length greater than the thickness of the metal at the places where they occur, and the patternmaker has to resort to various subterfuges to so place them on the pattern that they can be withdrawn from the mold. The figures given do not show any patterns of special interest, but they serve to illustrate different methods employed, which vary widely with the conditions.

Fig. 1 shows two bosses on a pattern which is in halves and having the interior cored out forming a shell. The pieces are simply wired on, and, after each half of the pattern is removed from the mold, the loose pieces are withdrawn.

Fig. 2 is supposed to represent a pattern of some considerable depth, with both interior and exterior projections, *A* and *B*, where the entire inside is lifted with the cope, or, in common language, "coped out." The bosses here can be of almost any size and length without causing trouble; for, when the wires are withdrawn and the cope is lifted, *A* comes with it and is then removed, while *B* is taken out after the pattern is drawn, coming into the large cavity thus left.

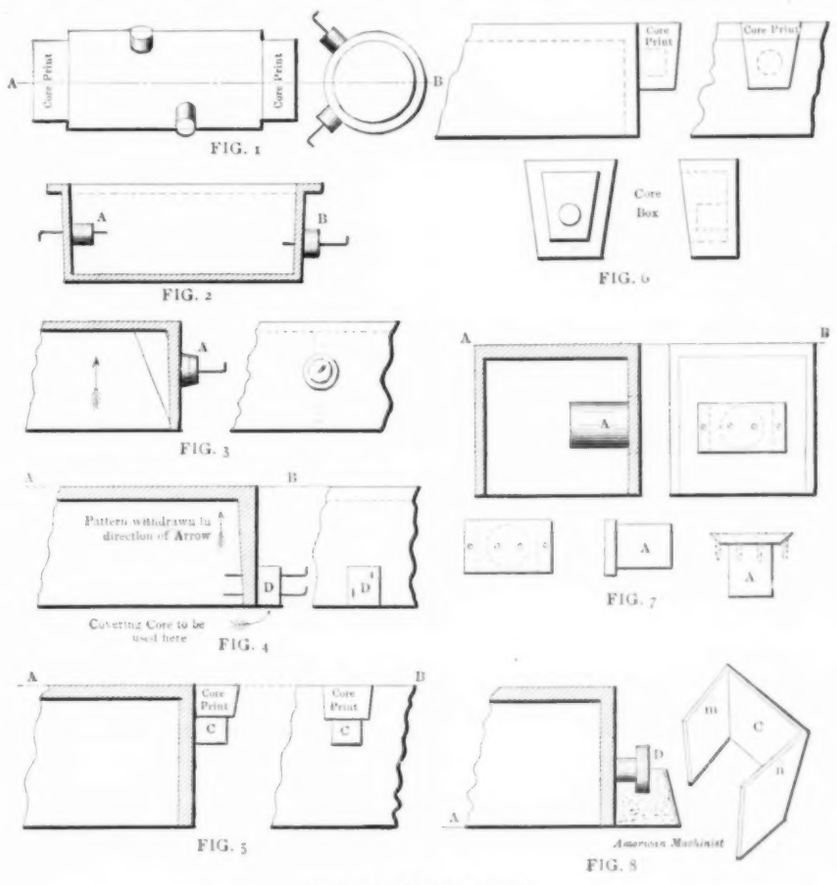
Fig. 3 shows a boss attached loosely with a wire, but in two parts. The example taken is more favorable for this method than are the others shown, for the piece to be drawn is tapering on the sides, and there is a rib directly behind it, which leaves plenty of room to insert the draw wire. The body of the pattern is supposed to have a flat cope, and to be drawn out in the direction of the arrow.

Fig. 4 shows a case where a pattern has a boss even with the lower edge and a covering core is used. The pattern is placed with the edge *A B* on a mold board, and is rammed up to the top level of the boss *D*, which is then removed; a flat covering core is placed over the cavity and the ramming of the nowel is continued to completion. After this the flask is turned and the cope, which is flat, is made. The entire pattern is in the nowel and the pattern is drawn in the direction of the arrow.

Fig. 5 illustrates one of the commonest methods of managing ears, lugs, etc., by means of a core print reaching from the top of the boss or lug to the parting line of the mold. If the boss was round it would have to reach to the center, and half of the boss would be made up in the core box. The principle indicated in Fig. 6 also is often employed, having the entire projection formed in the core. In such cases a block core print larger than the boss is attached to the pattern and the boss itself is placed in the core box, matching the print. The dotted lines shown within the core print in this figure show the position of the hub on the pattern. This way is more commonly used when the boss is either round or of some peculiar shape, and when it seems desirable for some reason to avoid loose pieces. A core is also often used when there are a number of projecting spots just alike in size and distance from the parting line.

Fig. 7 shows a case which would not be practical except on a large job. The conditions are that the pattern is of a shell or box character, with walls and a large hub on the inside. The pattern is to be drawn in the same direction as Fig. 4, and placed on the mold board and rammed up in the same manner, but no cores of any kind are to be used. A rectangular place is cut out of the wall of the pattern larger than the hub, and beveled on the two ends. A piece is next made to fit this, with its ends beveled to match and held with screws, having the boss fastened to its center with screws. In ramming the pattern after the hub *A* has been covered to some depth, the screws are loosened from the outside, and the cover piece with the attached hub is removed. The hub itself is now unscrewed, and the cover piece is screwed back in place, when the molding proceeds as though there had been no hub at all.

Still another way to manage a projection awkward to mold is shown in Fig. 8. It is by means of an iron drawback or pocket shown in perspective at *C*, and placed in position against the pattern at *D*. The edges next the pattern are beveled to a knife edge, and the top of the drawback comes to the middle of the boss. It is put against the pattern, which stands on the mold board at *A B*, and is filled with sand first; then the entire outside of the pattern, and pocket or drawback as well, is rammed up, and when the flask is turned and the cope is made and lifted the pattern can be rapped and the pocket drawn first, which gives ample space to clear the boss, when the body of pattern is next withdrawn. Two small holes in the edge of the pocket at *m m* provide a means for lifting it.



WAYS OF MOLDING BOSSES.

Heating in Red Hot Lead.

BY E. R. MARKHAM.

Since the publication at page 321 of my former article under this title, I have received a number of inquiries as to methods of doing certain classes of work not touched on in that article; possibly the answers to these questions might be of interest to the readers of the AMERICAN MACHINIST.

A says: "I have trouble in hardening broaches heated in a crucible of lead; can you tell me any method I can use that will prevent the lead from sticking to the broach teeth?"

Ans.—The solutions mentioned in my first article, if made strong enough, might prevent lead from sticking to the pieces

mentioned; but I have used with very marked success a mixture which is used in the United States Government shops. This formula is taken from the report of the Chief of Ordnance of the War Department of the United States and is used when hardening files. I have used it with very gratifying results when hardening such work as small milling cutters, taps, reamers, broaches, cherries, rotary files and similar tools having fine teeth likely to hold the lead. The following is a copy of the report:

"Before hardening, the files are treated with a mixture of salt and carbonaceous materials, to protect the teeth from decarbonization and oxidation. The kinds and proportions of the ingredients are exhibited in the following table:

Pulverized charred leather..	1 lb.
Fine family flour.....	1½ lbs.
Fine table salt.....	2 "

"The charcoal made from charred leather should be triturated until fine enough to pass through a No. 45 sieve.

"The three ingredients are thoroughly mixed and incorporated while in a dry state, and water is then added *slowly* to prevent lumps until the paste formed has the consistency of ordinary varnish. When ready the paste is applied to the file with a brush, care being taken to have the teeth well filled with the mixture. The surplus paste is then wiped off the file by the brush and the file is placed on end before a slow fire to dry. If dried too quickly, the paste will crack or blister; if not dried enough, the remaining moisture will be transformed into steam when dipped into the heated lead bath and cause an ebullition or sputtering of the lead, throwing out minute globules of the latter which may endanger the eyes of the operator. The fusing of the paste upon the surface of the file indicates the proper heat at which the file should be hardened."

I am aware that file makers have methods of hardening files that differ very materially from the above process, but I consider it particularly valuable when applied to the tools mentioned.

B writes: "I have a great many small pieces to harden. We heat them in a crucible of red-hot lead. We were formerly bothered with lead sticking to the pieces, but since seeing your article in the AMERICAN MACHINIST we have dipped them in the cyanide solution before putting them in the lead. Our trouble now is that the pieces do not harden uniformly; one side will be harder than the other. We heat fifteen to twenty pieces at a time, taking one piece out and putting another in its place. Can you suggest a remedy?"

Ans.—Probably your trouble comes from *uneven* heating. The pieces if placed in the crucible would of course stay at the top, and unless turned frequently would heat unevenly, as the portion below the surface and immersed in the lead would become hotter than the part above the surface, and exposed to the air. In order to avoid uneven heating and possibly decarbonizing the surface exposed to the air, the pieces should be turned frequently, and the piece which is to be taken from the crucible and hardened should be held below the surface of the lead a few seconds before removing, in order to equalize the heat. It may then be taken from the crucible and hardened.

C writes: "I hardened a lot of pedal axles for bicycles. The steel used was evidently too high for this class of work and hardened entirely through. We attempted to draw them to a blue each side of the bearing, and, as it was necessary to anneal the thread end of the axle where it screwed into the crank, we thought we might kill two birds with one stone, so we dipped the thread in the molten lead, leaving it there until that end was red hot and the portion above it drawn to a blue. We found quite a number of the axles cracked in the thread and at the shoulder above the thread. We drew quite a number of the axles in a gas jet, and, as none of these cracked, we concluded that they cracked in the lead. Do you think this was the cause, and, if so, what is the remedy?"

Ans.—A piece of *hardened* steel is very liable to crack if immersed suddenly in red-hot lead without previously heating to a point that makes it somewhat elastic. If such a piece as you mention is to be *drawn* in the lead, it should be immersed for a short distance and immediately withdrawn, then immersed a little deeper and withdrawn, repeating the operation until the steel is heated to a point where the intense heat will not cause it to crack from the sudden change in temperature. A piece of steel hardened throughout is unyielding and the effect of a sudden immersion in the lead would be to violently expand the outer portion of the steel, while the inner portion and that directly connected with the heated portion, but which was not in the lead and consequently not heated, so that it could not expand, would resist the action of the heated portion, and, as a consequence, would crack. I have been informed that since the adoption of the suggestions mentioned the trouble has ceased. While other troubles of a similar nature may present themselves, I think the question and answers mentioned pretty well cover the ground.

Combination Iron Flasks.

BY R. H. PALMER.

In providing flasks for a jobbing foundry the question arises, how to make the flasks so they that will take in patterns of about certain sizes but of different styles, and so build them of iron that they can be easily altered.

Fig. 1 shows an iron flask bolted together at the corners, the sides some ⅝ inch thick, with flanges or ribs on each of the sides; these ribs are set back from the edge about ⅛ inch, while there are four rows of holes and trunnions. The ends are plain, with flanges at each of their ends to bolt the sides against. The holes in the sides not used for bolt holes to fasten in bars, form vent holes, and by having them in lines the bars may be placed to meet the pattern as required.

It will be seen that the end is left with a large, round opening, as there have been pipes made in it. Bolt holes *B* also are seen; should occasion require, a plate made in open sand with holes in it can be cast and bolted against the ends of each half to close the hole. The flask sides were drilled for pin holes in the ribs *C*, so that one may place one half on top of a cope and make a three-parted flask, or as many parts as he wishes; then the holes often come handy for bars in a cheek. In leaving the rib back from the edge a fraction of an inch it forms a chipping piece around the edge so that it can be easily chipped to fit together in case there is any rocking of the part on another. The bars in the cope are cast with a part of the circle cut out for pipe; by coring a few holes in these bars, chucks are easily bolted in as required. As these holes are ½ inch, a number of spikes easily fill them and a wooden bar can be fastened in.

Fig. 2 shows a piece cast with holes to match those in the side of the flask. If a flask is required longer, take out the end of one, butt it against a second, and use piece, Fig. 2, to tighten together; take short bolts out of the brass and use longer.

In making flasks which are wanted to be, say, 18 or 24 inches deep, instead of making the nowel or drag the full depth required, divide the depth in at least two or three sections. I have many times found it better in making a flask where a deep nowel was required to make it in sections, say, 8 or 9 inches in depth, or 8 and 12 inches, having holes bored so that when it was through with the job it was made for, if occasion required, the bolts holding it together could be removed and the same holes used as pin holes. Bars of the required shape were cast, and a shallow flask was the result.

In every jobbing foundry there is a certain run of work that seems natural to that foundry and that requires flasks of certain sizes, but varying principally in depth. A flask may be quite long and perhaps of slender build apparently, yet easily handled if arrangements are made to hitch on to it so as to properly balance it when hoisting with a crane.

In casting trunnions on a flask I have them made in a core, and set the core where I wish a trunnion, and ram it up in the mold.

On the larger flasks of iron an arrangement, Fig. 3, combining a staple to hitch into when rolling over a heavy cope, may be found very useful. In making it a rib is added on the pattern extra heavy with a core print.

Flasks of different lengths and widths of the above style will be found very con-

venient. We have them from 30x36 inches up, and in the style of flask I have shown. If a smaller flask is required for green sand, drop a piece of board in the ends to close up.

In regard to pins for iron flasks, a foundry usually finds them quite expensive, even if a machine shop is a part of the concern. I have tried coring some holes in the side of the cope and casting a cast-iron guide *a*, Fig. 4, and bolting it to the cope. If one is broken it is easily replaced. I like cast iron better than wrought, which gets bent unless very heavy. If cast iron is used and gets broken (which I have not had happen), throw it among the bad castings and replace it.

Another style of pin is shown in Fig. 5. The same sized hole is bored in the cope and nowel flanges. The pin is tapered but very little for three-quarters of its length, and near the smaller end it is tapered more. The larger end is simply too large to drop through the hole. I find the pin works very nicely and is very cheap. I had one turned out of wood and gave it to the molder, who cast it on end. We rattle them and they are ready for use.

Now, if in the flask where we use these pins we are making a casting requiring a long steady pin, we have a set of long pins made of common round iron, with one end an inch or so bent square over and the other drawn out a little, but not to a sharp point. We drop these pins through the holes in the top flange of the cope, passing down through the hole directly under in the lower flange of the cope and through the hole in the top flange of the nowel, and we have them as long as we wish. In some flasks we use 5/8-inch round and some 3/4-inch, the holes being bored large enough for the round iron to pass through easily.

In making iron flasks they can be made quite light if well ribbed on the sides, but there is a limit either way. One often sees castings strained because the flask is not stiff enough to withstand the side strain, and the man making it does not realize the amount of strain on his flask and does not provide side binders, or top and bottom binders when there are lifting strains.

In providing for the handling of large flasks, I have been in the habit of casting a piece of casting like Fig. 6, making them of different lengths and sizes so that they could be changed from one flask to another, and bolted on to the sides of cope and nowel. In hooking into them and rolling over a large cope, it is better to wedge or block around the hook, but the size of the staple is regulated by the sizes of hooks on chains. Often a piece of rag wound around the staple will do the business, but the safest way is never too safe.

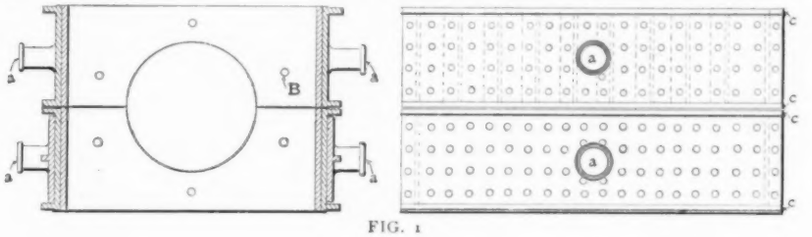


FIG. 1

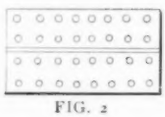


FIG. 2

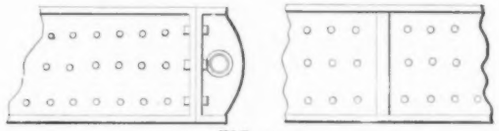


FIG. 3

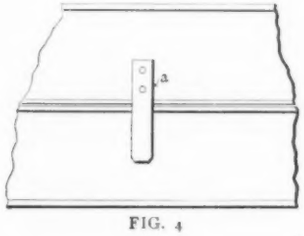


FIG. 4

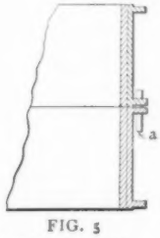
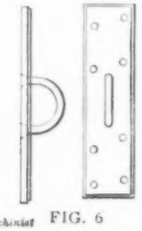


FIG. 5



American Machinist FIG. 6

COMBINATION IRON FLASKS.

I have the staple upset on the ends, have a rough pattern made the size I wish, burn out the holes for bolts with an iron, also the holes for the staple, set the staple in the pattern and mold. I had some cast with the staple just nicked, instead of upset, to keep from pulling out, but as the nicking was done too deeply the staple broke out and it came near being a bad accident while rolling over; so I had rather have them upset.

In general, where light crane flasks are used, iron ends will be found very serviceable. Once in a while you will find a molder who will not look at his cope to see if the bolts are tight, and who will cuss the flask because he did not and because the flask cannot keep itself in order, but he is usually one of those men who find everyone to blame for their own carelessness, not themselves.

Considerable changing about can be done with iron ends as well as wooden. I have a flask in the foundry in use by one of the molders which was made from an old lathe-bed flask some 6 inches thick. It is fastened together by bolts extending from side to side outside the ends. The cheek was originally altered to some 6 feet 6 inches square by 25 inches deep and a tank was swept up in green sand in it, some 5 feet 10 inches in diameter by 25 inches deep. It was then unbolted and packed away. Later the sides were used, ends were put in and a pipe 15 inches in diameter was swept, this part was barred up for a cope for it. It has now been taken apart again, the ends as used for the tank have been replaced, and a ring is made in it some 7 or 8 inches in width, 12 inches deep on the inside and 8 inches on the outside, a green-sand core rising between the two, but the two are connected with plates on top of the core. Meanwhile the bolts did duty as binder bolts. I have some flasks made in the same way where the ends are not gained into the sides, simply butted against them, and where the ends have been moved back and forth according to the size of piece to be cast.

Tap Drill Sizes for V-Threads.

BY L. O. DANSE.

Most of us who are obliged to use sharp V-threads—and in this part of the country the United States standard is a rarity—have had an abundance of troubles with the ordinary tap drill tables; troubles that have ranged all the way from too tight fits, causing loss of time and broken taps, to the opposite extreme of threads affording so little hold as to seem quite precarious.

These experiences have frequently led to the adoption of special private drill tables differing more or less from the original standard. The difficulty is aggravated by the variation in the diameter of the holes drilled after different grindings of the same drill; and that is a trouble of sufficient magnitude in itself, though not the one uppermost in the writer's mind at present.

Very few have the inclination or patience to take up these vexatious little matters in connection with a manufacturing business and follow them far enough to secure a rational solution to the problems involved.

One of the few who are gifted with these rare qualities is my friend Henry M. Leland, of the Leland & Faulconer Manufacturing Company, and he has been studying the tap drill question for years with that minute and careful scrutiny which makes his conclusions of real value.

As is well known, the diameter of a screw, with sharp V-thread, at the bottom of the thread, is equal to the

$$\text{Outside diameter} - \frac{1.733}{\text{No. of threads per inch}}$$

The diameter of the tapped hole must exceed this by enough to let the screw in

readily, and it is evident that the play proper for a No. 2 screw would hardly be suitable for a 1½-inch screw, nor does it necessarily follow that the play varies directly in proportion to the diameter nor to the number of threads.

After careful examination with a magnifying glass of a great number of tapped holes, Mr. Leland at last came to the conclusion that, in a formula for the diameter of the tap drill, the constant must bear some relation to the tap diameter—in other words, the formula itself must vary to some extent with the size of the tap.

Having determined this fact, there remained to be decided what were the practical manufacturing limits of the ordinarily accepted formula, and what others must be evolved.

By using a magnifying glass on holes tapped expressly for the purpose of settling the question, Mr. Leland found that the formula should take the following forms:

From 7-16 inch up, the root diameter is equal to the

$$\text{Outside diameter} - \frac{1.200}{\text{No. of threads}}$$

Below 7-16 inch, down to and including ¼ inch, use 1.100 instead of 1.200 for the constant.

Below ¼ inch, down to and including No. 10, use 1.000 for the constant.

Below No. 10, down to and including No. 5, use .900 for the constant.

From these formulas the accompanying table was calculated.

Size of Screw	Tap Drill.	Size of Screw.	Tap Drill.
3/16″ x 24	No. 26	No. 5 x 32	No. 41
¼″ x 20	13/64″	" 5 x 36	" 40
5/16″ x 18	¼″	" 6 x 32	" 35
3/8″ x 16	19/64″	" 8 x 32	" 29
7/16″ x 14	25/64″	" 10 x 24	" 26
½″ x 12	13/32″	" 12 x 24	" 17
9/16″ x 12	15/32″	" 14 x 20	" 11
5/8″ x 11	35/64″	" 16 x 18	" 4
¾″ x 10	5/8″	" 18 x 18	15/64″
7/8″ x 9	¾″	" 20 x 18	¼″
1″ x 8	55/64″	" 21 x 16	17/64″
1 1/8″ x 7	61/64″	" 28 x 14	11/32″
1 ¼″ x 7	1 7/64″	" 30 x 14	3/8″

TAP DRILLS FOR V-THREADS.

This table gives about three-quarters full threads, giving ample hold for the screw, with easy tapping, and has proved very satisfactory.

In this connection the writer would like to call special attention to a most excellent scheme in use at the Leland & Faulconer shop. When a machinist applies at the toolroom window for a tap, the attendant hands him a block of cherry, nicely varnished, having stuck into it three taps, plug, taper and bottoming, together with the tap drill. This saves all guesswork, saves the time required to look up a tap drill table and prevents errors. The scheme is well worth adopting.

Shop Notes from the Factory of C. H. Besly & Company.

This shop, located at Beloit, Wis., is devoted to the manufacture of specialties, of which leading ones are compression grease cups, taps and the Gardner grinder, including the emery-coated paper disks or "circles," as they are known to the trade, which are made for use on the grinder in immense quantities. Most of the manufacturing equipment of the works is special and home made. The usual earmarks of home-made machines are, however, conspicuously absent, the special tools being, in fact, models of the machine-tool designer's and maker's arts.

Fig. 1 shows the machine with which the glue is applied to the paper circles and a prettier operation is seldom seen. The flat revolving disk has a clamping screw in the center by which the paper is secured to it. Projecting from the rear is an arm which carries three glue pens which trace the spirals of glue on the paper. Above the machine is a tank of glue, which is under air pressure, and a rubber tube connects the bottom of the tank with the pens. Gas burners keep the glue hot, though for some grades of paper fish glue is used which, of course, does not require to be kept hot. As the paper-covered disk revolves the pens are fed outward or inward as the case may be (the motion being reversed for each circle) and the paper is quickly covered with the glue spirals, when it is placed under the spout of a bin of emery and completely covered with it. The surplus is poured off and the sheet is run through a pair of rolls which bed the emery in the glue and reduce the whole to uniform thickness and surface. The sheets to the number of thousands are then placed on racks to dry.

Mr. Gardner believes in his own grinder and uses it for many operations for which milling machines would commonly be used. Fig. 2 shows a double disk grinder. The disk nearest the observer is fixed, as regards endwise movement, but the spindle of the other one has an endwise movement which is controlled by the handle in the operator's right hand. An adjustable stop (not shown) limits the movement for duplicate work. Between the disks is a work support and on it is a flat slab of steel which is a blank for one of Besly & Co.'s parallel clamps with which our readers are familiar. A stick of wood in the operator's left hand, with a notch to embrace the piece of work, completes the outfit.

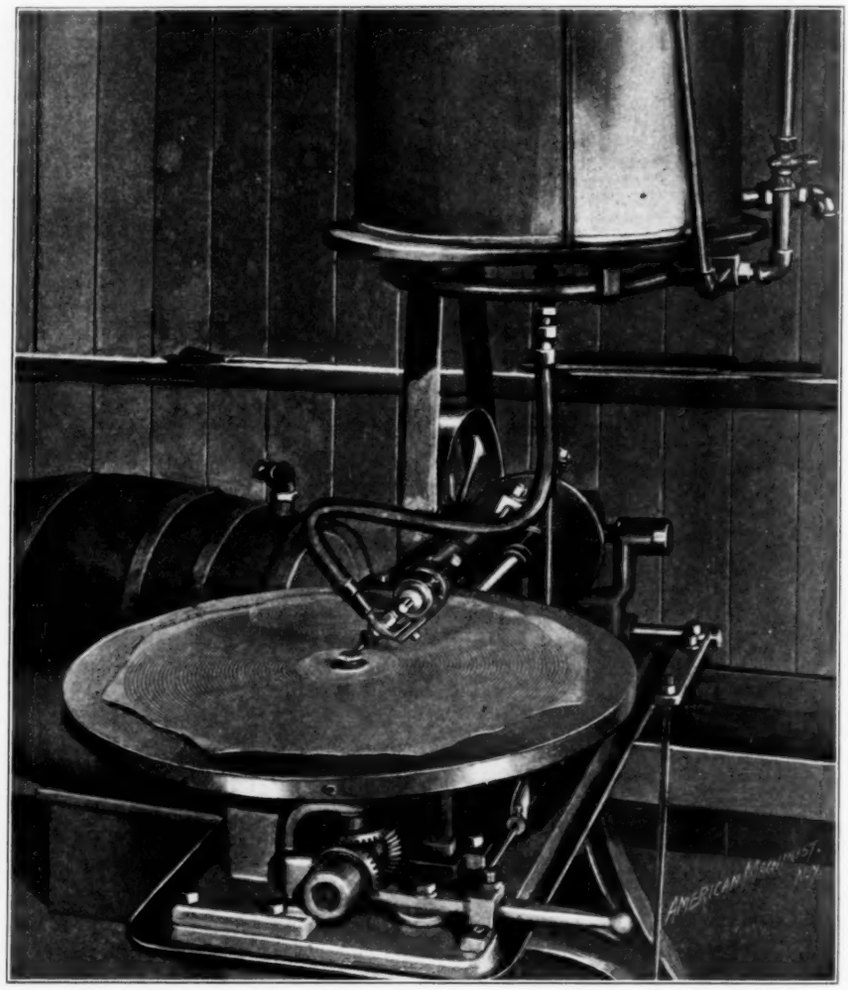


FIG. 1. MACHINE FOR APPLYING GLUE TO EMERY PAPER CIRCLES.

Drawing the disks together and at the same time reciprocating the work on its support, the edges are finished—square and parallel—and almost before the method can be described.

Fig. 3 shows a use made by Mr. Gardner of his grinding and polishing band, which was described at page 1225, Vol. 24. This band is similar in principle to the circle of the disk grinder, but is applied to the edge instead of the face of the iron wheel. The ends pass inward through a gap in the iron wheel surface and the whole is drawn together by a screw clamp. The operation shown is the polishing of the shank of a long shanked nut tap. A notched stick supports the work, the natural revolutions of which are held back by the right hand of the operator.

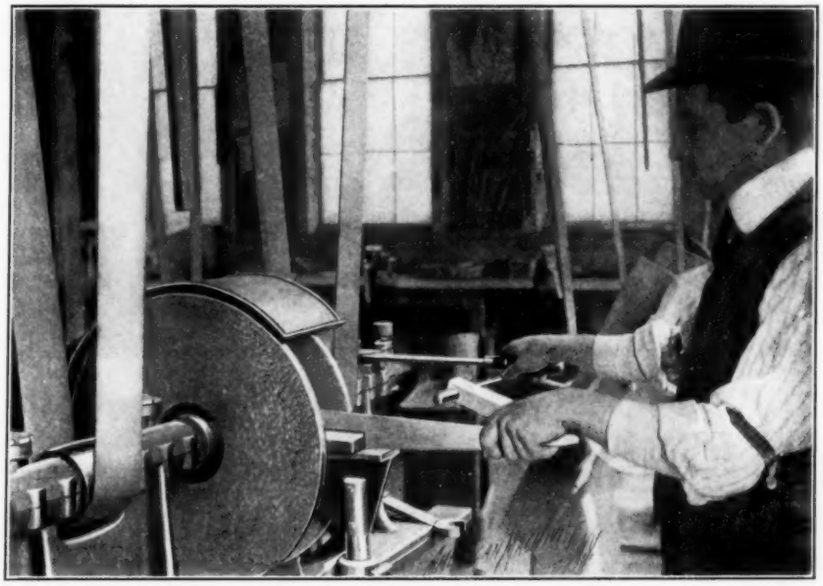


FIG. 2. DOUBLE DISK GRINDER FINISHING THE EDGES OF A PARALLEL CLAMP.

Fig. 4 shows one of a large number of tap threading machines which are highly interesting, though not adequately shown by the illustration. The blank is held and driven in its spindle by a draw-in chuck operated by the pilot wheel in the rear. As a great variety of lengths of shanks are required, the shank does not bottom against a stop gage, but a bent finger gage is used to locate the blank by the rear end of the threads. The feed is direct by a comb *a* of the same pitch as the tap and a short screw mounted on the spindle and meshing with the comb. The threads are cut by a pair of milling cutters—roughing and finishing—and there is no relief to the back of the threads except that due to the fact that the tap is slightly taper—the rear end being the smaller. The hand wheel which appears at the left traverses the carriage back for the next tap after the feed comb is released from its screw by the handles shown. Micrometer cross adjustment for the milling cutters is provided, but the cutter carriage is free from the screw which is a stop screw only. A handle (not shown) moves the carriage to and from the work independently of the screw, and by thus moving the carriage away from the screw the latter is relieved of all duty and there is no slack between it and the carriage. Adjustment of the cutters can thus be made in either direction by the graduated dial and without embarrassment from lost motion. The pilot wheel which appears in the foreground operates the draw-in chuck of the next machine in the row.

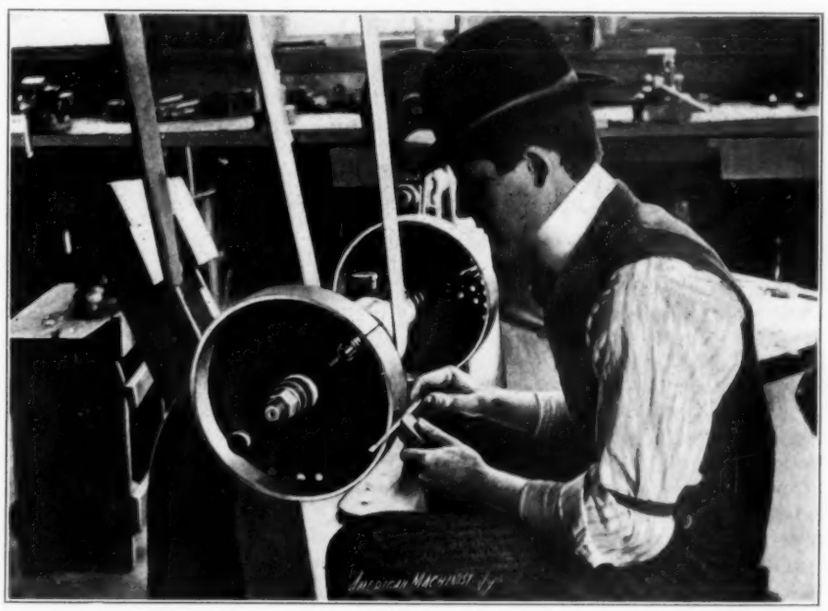


FIG. 3. FINISHING THE SHANKS OF LONG NUT TAPS.

Fig. 5 shows—though inadequately—a dainty little machine for fluting small taps. The tap blank is vertical and by a very compact arrangement of spiral gearing four (or in the case of the machine partially shown in the foreground, three) cutters are driven simultaneously. Each cutter head swivels about its vertical driving shaft and a cam arrangement below swings the heads to give a deeper groove at the point of the tap.

Fig. 6 shows a tap swaging machine which is just out of the experimental stage. Nut taps require to have the shank reduced to the size of the bottom of the threads, and as the shanks of such taps are long this leads to considerable waste of both material and labor. Fig. 6 is a machine for swaging the lands up to the full size of the tap from material of the size of the shank. The machine operates much after the fashion of a punch press. The horizontal driving shaft at the right and the vertical connecting rod actuate the reciprocating ring to an ear of which the connecting rod is connected. The dies are connected to this ring by a series of toggles and project inward, their ends being within the opening. The heated end of the blank is inserted within this opening and a foot lever is operated, when the driving shaft makes a quick revolution and the work is completed in a twinkling. Some of the swedged blanks will be seen lying on the bed of the press.

Fig. 7 shows a mechanical gem which in the matter of output undoubtedly holds the record. It is a novel multiple spindle drill for light work and it has a record of over 5,000 holes a day and for days together on continuous work an average record of over 3,000 a day. In work suited to it the capacity of the machine outruns itself, so to speak, being in excess of the capacity of the operator for feeding it, the actual output being determined, not by the machine, but by the dexterity of the operator.

As before stated, large numbers of compression grease cups are made in these shops, the bottoms of which have to be drilled and tapped for connecting a nipple

which screws into the oil hole of the bearing to be lubricated. The machine shown is for drilling these bottoms and also for drilling the nipples—these nipples being made because commercial pipe nipples are not considered good enough. The cup bottoms are drilled from cored holes, the drilled size being about ½ inch diameter by ½ inch long. The nipples are drilled from the solid, the holes being, of course, smaller but longer. As shown, the machine is set up for drilling nipples. The drill spindles and work tables to the number of ten each are grouped around a central column, and when the machine is in motion they revolve together and continuously about this column. Each work table has a special chuck for the work in hand, each chuck having a small knobbed handwheel which may be operated without stopping the machine. The work table spindles ride on a cam which surrounds the central column below, and as the tables and drill spindles revolve about the central column, each table rises and falls once for each revolution, this motion being the feed. The operator sits opposite the lowest position of the tables, and as each one passes him he removes the finished piece of work and inserts a fresh blank. A tank of oil will be seen above, from which a pipe leads to each drill, this tank revolving with the drill spindles and work tables, and a pump being provided to carry the used oil back to the tank. The machine is driven by two belts, one for the drilling motion and one for the feed. The former motion is adjustable by a pair of cone pulleys and the latter by change gears.

Mr. Gardner believes in grease lubrication, and his shop is the first one which we have seen in which practically no oil cups are to be seen—the bearings of all machine tools, as well as of the line and counter shafts, being regularly fitted with grease cups instead. Examples of this use of grease cups will be seen in Figs. 2, 3, 4, 6 and 7. Fig. 8 shows his method of solving the loose pulley lubrication problem. A hole *a* is drilled down the center of the countershaft, and at the center of the loose pulley hub a cross hole *b* is drilled. The end *c* of hole *a* is tapped with a pipe thread and a grease cup is inserted there which forces the oil down the shaft to the place where needed. We have seen this plan in use before, and there can be no doubt that it is a complete and satisfactory solution of one of the minor nuisances of the machine shop—squawking loose pulleys on high-speed countershafts. In addition to this it overcomes the difficulty of flying oil, which is apt to saturate the belts and thus make a double, or treble nuisance. The countershaft shown is Mr. Gardner's own make, and an excellent feature of it, which will not be overlooked, is the length of the loose pulley hub. The advantages which are found to attend grease lubrication are economy and cleanliness; although, in addition to these, Mr. Gardner considers that the positive, though slow, movement of the grease from the center of the bearing outward is far more favorable to preventing the entrance of grit into a bearing than are the conditions which accompany the use of oil.

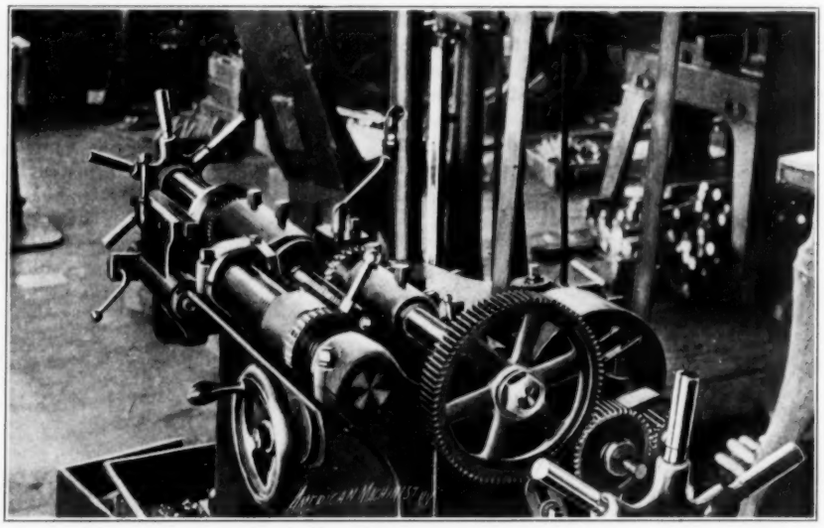


FIG. 4. TAP THREADING MACHINE.

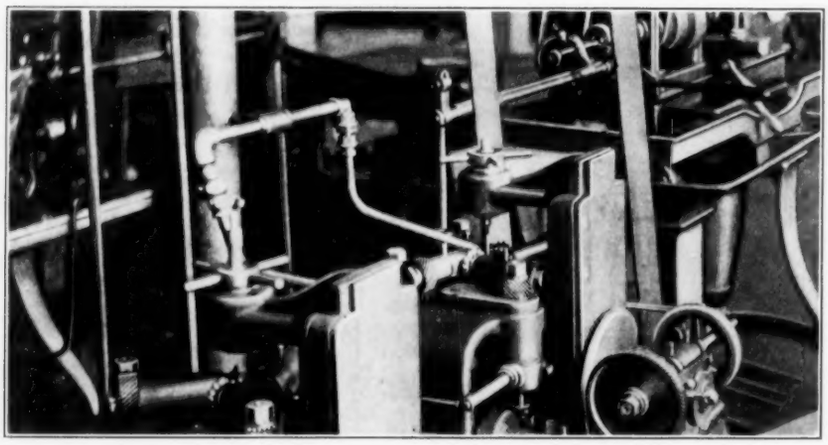


FIG. 5. TAP FLUTING MACHINE.

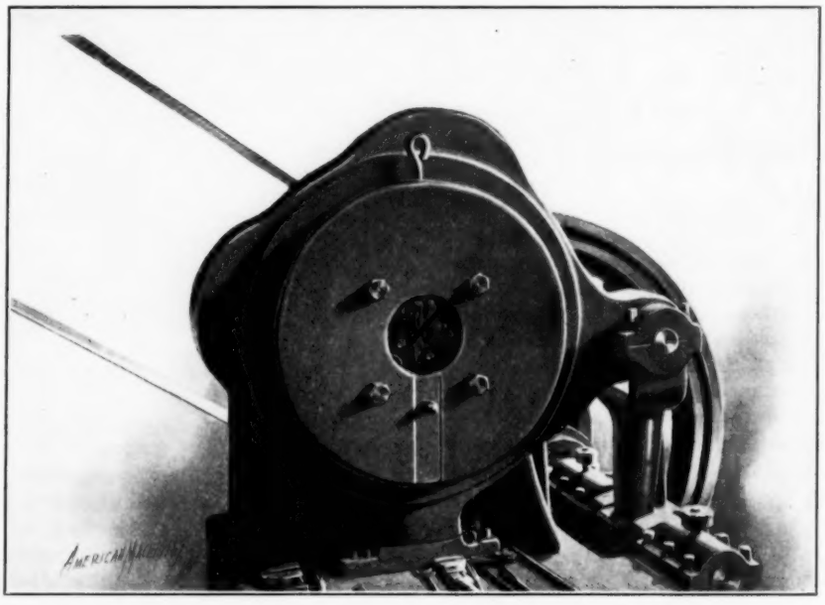


FIG. 6. TAP SWAGING MACHINE.

Fig. 9 shows a rod chuck for turret lathe or other work made from bar stock. It gives a powerful grip, is simple and very compact, and appears to have very few excuses for getting out of truth. The V-jaws *a* and *b* are closed by the forked wedge-shaped jaw *c c*, which in turn is advanced or withdrawn by the screw *d*. The movement of the gripping jaws is limited, and, in fact, is only intended to be sufficient to accommodate the variations in the size of the stock. The jaws are double-ended, and each pair thus accommodates two sizes of stock. The truth of the gripping jaws is easily maintained while the combined action of screw and wedges gives a powerful grip.

The remaining illustrations show a method of keeping track of tap orders in the shop. A large proportion of the taps made are for bolt and nut makers. Owing to the diversity of such work, orders cannot be filled from stock, and each lot is not easily maintained without special provision for that purpose.

Fig. 10 shows a rack on the side of the foreman's desk, containing a pocket for

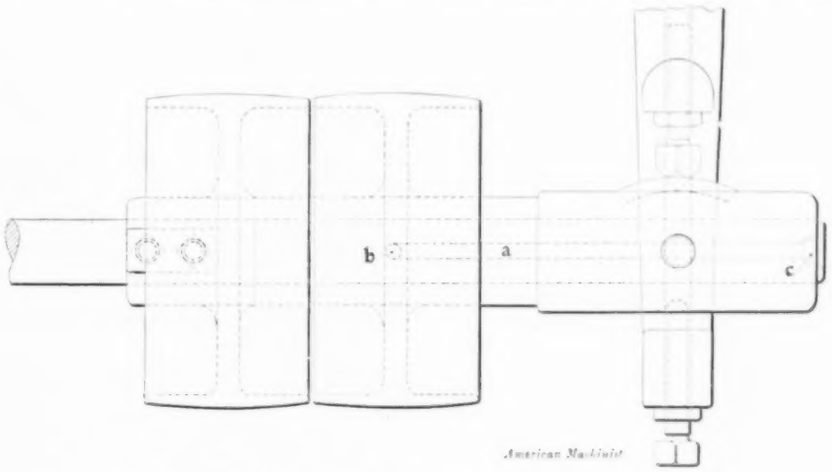


FIG. 8. GREASE LUBRICATION OF COUNTERSHAFT LOOSE PULLEYS.

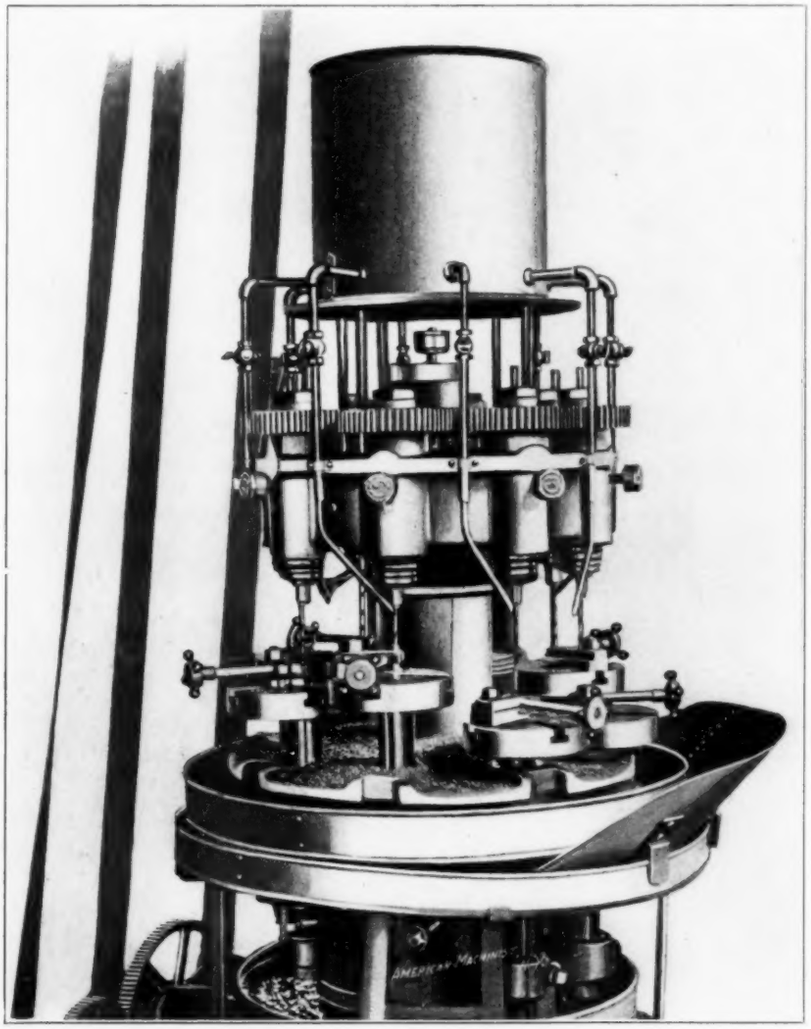


FIG. 7. MULTIPLE SPINDLE DRILLING MACHINE.

thus a special order. Taps are very much alike and at the same time contain essential differences, and the identity of each order in its progress through the shop is each operation through which a lot of taps goes, the pockets having on top of the divisions between them a label of these operations in their regular order, these labels corresponding with the captions at the left of the "tracer card," Fig. 11. On receipt of an order, the office makes entries at the top of a tracer card for the order number, the date and—opposite "Memo"—the name of the party ordering the taps. Opposite "Ordered" are entered the size and quantity, and at the bottom the promised date of delivery and any other special memoranda that may be pertinent to the job. In this condition the card goes to the foreman, who files it in the first pocket of the rack labeled "Ordered," where it remains with similar cards until work on the order is to be begun. The first operation is, naturally, cutting up the stock, and when this is to be done, the first three lines of an order card, Fig. 12, are filled in and the card is given to the workman with the stock. At the same time a check mark is made at the left of "Cut off" on the tracer card, and it is placed in the cut-off division of the file, the presence of a card in that division showing that the taps for that order are in that stage of progress. When the cutting-off is completed, the order card is returned to the foreman with the blanks, the workman having filled in the lower two lines. The foreman verifies the workman's count and makes the entry in the "Cut off" line of the tracer card, the order card being attached to the work for identification. The first three lines of a new order card are then made out for the centering operation, a check mark is made at the left of "Centered" on the tracer card, and it is advanced to the "Centered" pocket of the rack; and so on until the work is completed, when the tracer card contains its complete history and is sent back to the office to announce that the work is completed. It will be seen that the foreman has before him, in his collection of tracer cards, a sort of bird's-eye view of the shop, showing the condition and position of every job in the tap department. He can give preference to hurry orders and can answer any inquiries regarding the state of progress of such orders without leaving his desk.

A Successful Evening School.

BY H. E. HARRIS.

In response to a number of inquiries for additional information regarding the Tottenville Evening School, of which you published an account at page 937, I wish to take advantage of your columns and give a general reply.

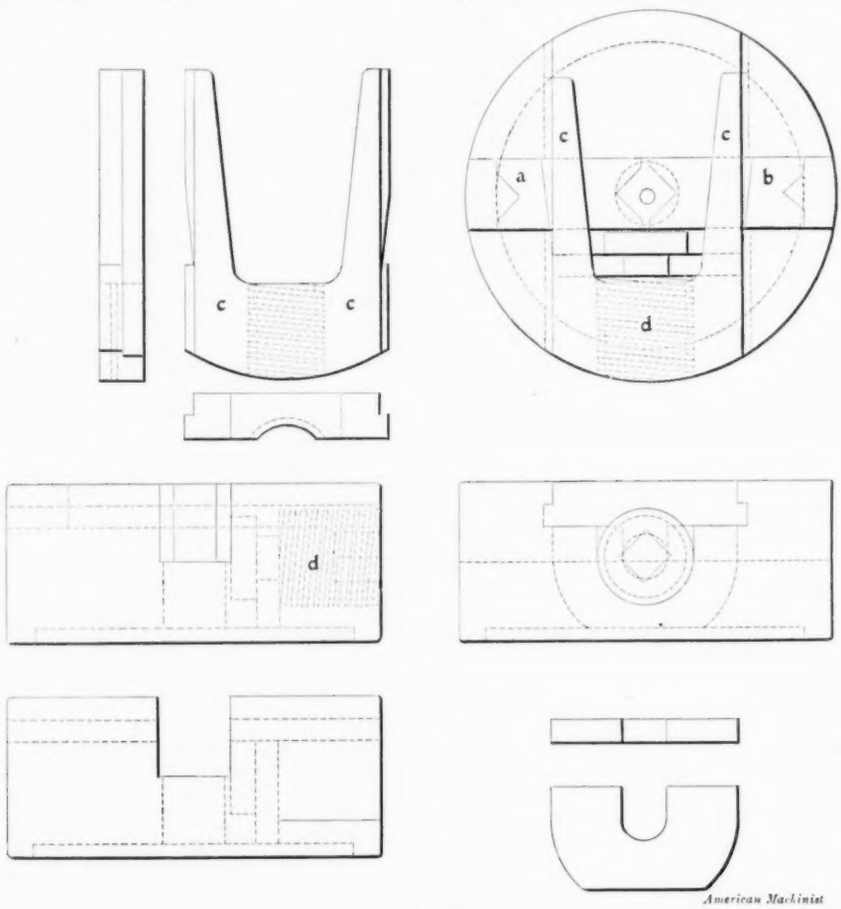


FIG. 9. ROD CHUCK.

In the first place, the two or three young men who were first interested in the scheme canvassed among their friends and when there were about a dozen ready to join they met in the Murray Manufacturing Company's office, elected a chairman *pro tem.*, and held a meeting. A committee was elected to wait on the representative of the New York Board of Education with a petition for the use of the Tottenville school house, to be presented at the next meeting of that body. Another committee was appointed to write a notice for the local papers, some of which added a recommendatory editorial. The Board of Education returning a favorable reply, another notice was given of a meeting in the school house, when all young men would be welcome. The attendance at this meeting was quite large and some of the organizers took the floor and made addresses, mapping out in a general way the scheme of organization. A president, vice-president and recording secretary were elected and a committee was appointed to draw up by-laws. The nights for study were decided by majority vote, and the names of those wanting to join were taken and a date set for a future meeting. At this later meeting the by-laws were submitted and voted on, some being slightly amended before acceptance. The treasurer and financial secretary were elected and the members regularly enrolled. The officers were elected honorary members, having equal rights with the other members, but having no dues or enrollment fees to pay. The name of the association, as proposed and accepted by vote, was the Richmond Technical Association, being in Richmond County, N. Y.

The By-Laws Committee, having ascertained prior to this meeting that Mr. N. J. Lowe, the High School Principal, would teach mathematics, and that I would take a class in physics without charge, and that my services as instructor in mechanical drawing could be obtained at the nominal figure of $2 per night, estimated what the opening and current expenses would be, and were guided accordingly.

Knowing that the attendance of a night school is prone to diminish, and guided by the advice of Mr. Lowe, it was decided to have each member place a stated amount in the treasury upon enrolling, to be returned at the end of the term, in case of satisfactory attendance on the part of the member, but otherwise to be forfeited to the association. This proved a very wise measure, holding several members to the mark toward the end of the term, when the days grew longer and other evening attractions became plentiful.

The by-laws are as follows:

1. The officers of the association shall be president, vice-president, treasurer, recording secretary and financial secretary, to be elected by majority vote.

2. The president shall call business meetings of the association or of the Board of Officers when he deems it necessary or at the direction of the Board of Officers, and preside at all meetings.

3. The vice-president shall assume the duties of the president in case of his absence.

4. The treasurer shall receive all moneys paid into the association from the financial secretary and give him a receipt for the same. He shall also render his report at each monthly convention of the Board of Officers. He shall also pay to the financial secretary moneys for the expenses of the association upon receiving duly signed vouchers for the same.

5. The recording secretary shall keep the minutes of all meetings, shall keep all

FIG. 10. TRACER CARD FILE.

records and correspondence, and receive all receipts of bills against the association within ten days after the payment from the treasury to the financial secretary.

6. The financial secretary shall collect the dues each Friday night and shall also collect all enrollment fees, money due for material, etc., and turn the same into the treasury within three days after its collection and receive a receipt for same from the treasurer. He shall pay all bills against the association by money drawn from the treasury on a duly signed voucher. He shall draw up a regular voucher for the amount of each bill, sign it and have it countersigned by the president and the recording secretary or vice-president before presenting it for payment. He shall turn over all receipted bills of the association to the recording secretary within ten days after the money therefor has been drawn from the treasury. He shall also render his report at each monthly convention of the Board of Officers.

7. The officers of the association shall consitute a Board of Officers and convene regularly on the last class night of each month. The officers shall make their several reports, current matters shall be discussed, questions put in shape to be placed before the association, and all other business be attended to. The minutes of these meetings shall be held open by the recording secretary for the inspection of the members of the association for fifteen minutes prior to each class meeting.

8. The hours for study shall be from 7.30 to 9.30.

9. The classes for physics will meet Monday nights, and be divided into two periods of one hour each.

10. The classes for mathematics will meet Thursday nights, and be divided into three periods of forty minutes each. Members attending any one of these classes will be expected to do from 2 to 5 hours' home work per week.

11. The class for mechanical drawing will meet Tuesday and Friday night for a period of two hours each night.

12. Members may attend one or all of these classes at their option.

13. Each member, upon enrolling, shall pay $2 into the treasury, which will be repaid at the end of the term if the said member's attendance in the class or classes which he has entered has included seven-eighths of the term. In any other case it is forfeited to the association and may be used by the association in payment of its regular expenses.

14. Members shall pay to the financial secretary each Friday night their weekly dues of 25 cents each.

15. Members four weeks in arrears for dues may be dropped from the association by the Board of Officers and their two dollars enrollment fee will become regularly forfeit. Reinstatement in this case is only possible through a majority vote of a quorum of the association and re-enrollment in the regular way and paying another enrollment fee.

16. More than half the members must be present to constitute a quorum.

17. Members shall be fined for tardiness, five cents for each offense and one cent additional for each minute over five minutes. This fine may be remitted upon a satisfactory written excuse being placed before the Board of Officers through the president's hands at its convention.

18. The same rules shall apply to the classes of the association as in any regular school.

19. These by-laws can only be changed, amended or temporarily suspended by the full consent of the Board of Officers and a three-quarter vote of the entire association.

20. The present term shall extend from February 11, 1902, to May 27, 1902, inclusive.

TRACER CARD

Order No. *B1476* **Date** *4-15-02*

Memo *Blank Mfg. Co.*

Ordered . . .	*1000*	*¾ 10*	*U.S.S. Machine Taps*
Cut off . . .	*1025*	*Ryan*	*4-20-02*
Centered . .	*1025*	*Ormsby*	*4-25-02*
Turned . . .	*1025*	*Jones*	*4-30-02*
Threaded . .	*1025*	*Yuncker*	*5-10-02*
Squared . . .	*1024*	*Cole*	*5-15-02 (1 Spoiled)*
Grooved . . .	*1022*	*Williams*	*5-18-02 (2 Spoiled)*
Filed	*1022*	*Flynn*	*5-25-02*
Hardened . .	*1022*	*Dutton*	*5-28-02*
Finished . .	*1022*	*Woll*	*5-29-02*

American Machinist

Must ship June 1st.

Our Standard

FIG. 11.

ORDER CARD

Order No. *B1476 Blank Mfg. Co.*

Operation *Cut off* *10¼" long*

No. Pieces Started *1000 ¾ 10 U.S.S. Mach. Taps*

No. Pieces Finished *1025* **Workman** *Ryan*

Commenced *4-15-02* **Finished** *4-20-02*

☞ *When work is finished return this card to foreman* ☜

American Machinist

FIG. 12.

21. The time for the next term shall be decided by the Board of Officers and public notice duly given during one month prior to re-opening.

These by-laws as given above are substantially the same as the corrected and amended ones now held by the recording secretary, which, unfortunately, are not readily accessible to me during the vacation. They comprise the by-laws originally accepted, with additions, changes and some new ones.

Having received a large part of my own technical education in a night school and having had some experience with them, I would like to say a few words to you who contemplate organizing one:

In the first place, do not feel downhearted when some of the scholars drop out, but use your efforts to encourage the remainder; a night school is like a sieve, and though many enroll, the lazy, the stupid and the fickle boys are sooner or later sifted out and the industrious plodder, the naturally bright, and the ambitious remain, and while the class may be smaller the members of it do their instructors great credit. I always feel a relief when a shiftless pupil drops out, for one of that sort robs the rest of the class of its share of instruction and disturbs the more industrious pupils in his neighborhood. He is usually dissatisfied when he finds that a night school isn't all fun; he does not work himself and tries to hinder others in their studies. I found that some of the members who were the most enthusiastic at the start and who intended to make large examples of themselves soon became irregular in attendance and then seemed to feel that because they were not progressing with the rest of the class the school was a failure. I tried to get every one who joined to understand that a night school meant work, hard work, and success could only be obtained through a conscientious attendance and attention to his studies, and I am pleased to say that our project as a whole was a gratifying success.

In regard to the course of study in mathematics, Mr. Lowe examined the applicants and divided them into three grades according to their knowledge and taught them each 40 minutes each week and gave them home work to do which he corrected outside of the class. In physics, I took such practical subjects as the pump, lever, falling bodies, properties of matter, etc., and dictated laws and statements concerning the same to the class after giving a preparatory illustrative lecture. In mechanical drawing, I started to give a regular course in geometrical drawing, leading up to first angle projections drawn from models and so on; I soon found it impossible to keep all in the same grade, some of the scholars taking to drawing as a duck takes to water, and some requiring constant coaching and helping. Some of the pupils wished to learn everything pertaining to drawing, while others, such as the less ambitious or the master mechanics, simply wanted to acquire enough knowledge to make or read a plain drawing and cared nothing for geometrical drawing, projections, intersections, etc. So I have decided in the coming term to have three classes in drawing, viz., an advanced drawing class, taking up gearing, machine design, etc.; a beginning drawing class, which will draw from simple models and practice lettering, etc., and a geometrical drawing class, which will study geometrical problems, draw intersections, ellipses, angle projection, etc. A bright scholar with previous shop experience could attend all three and members of either the advanced or beginning drawing class could attend the geometrical drawing class at their option. All my class drawing work is done, as far as possible, from models, and although this makes it much harder for the instructor, the pupils advance much more rapidly and understand what they do more thoroughly. Working from plates is an abomination and does the pupil no good beyond acquiring the ability to use his instruments, as it is simply a case of copy, reduce, or enlarge.

[We cannot but think that the most encouraging feature of this school was that the initiative came from those who became its pupils. This, as well as the businesslike way in which the school was organized and conducted, are very notable. The fine hand and judgment of Mr. Harris were also, no doubt, large factors in the success of the school.—Ed.]

Notes By a Wandering Mechanic.

MAKING JIGS IN THE MILLING MACHINE—MACHINING PLANER TABLE RACKS—SCRAPING LATHE AND PLANER PARTS—ADJUSTABLE CLAMP BLOCKS—BORING MACHINE CHUCK—SUPPORT FOR LONG LEAD SCREW—TOOL FOR SPLINING A LONG SLEEVE—ADJUSTABLE ROD SUPPORT.

BY H. GOLDSMITH.

While I was in Pittsburgh the weather became very hot, and it struck me it would not be a bad idea to go to Philadelphia, as I should then be near the summer resorts and could run down to them over Sunday and spend the day in the surf. Acting upon the thought, I gave my foreman the customary notice and shaped my plans for the next stop on the program, reaching Philadelphia the latter part of July.

Soon after my arrival I wandered into the shops of Wm. Sellers & Co. and applied for a position, and after telling them what I had done I was told to start work the next day as a toolmaker in their monotype department. Then came the disagreeable task of finding a suitable boarding-house. After skirmishing around I

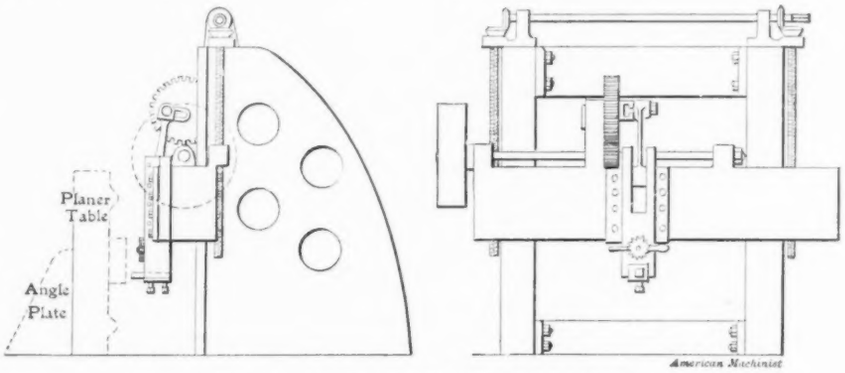


FIG. 15. SHAPER FOR PLANER TABLE RACKS.

At page 993 you publish an article by Mr. E. F. Scott, and I venture to raise my protest against a part of his valuable opinion. Don't, *don't* compel anybody to attend night school. Give him the opportunity; ask him, coax him to attend, but do not make it compulsory; an unwilling pupil is a detriment to the willing ones, a trial to his instructors and more harm is done him than good. Leave him alone if he will not come, and when he sees others getting ahead of him, if he has any of the proper material in his make-up, he will change his mind sooner or later and make a good pupil. Do not make the examinations compulsory either, but let the reward of increased pay be the inducement.

managed to find one and unpacked my trunk during the night. On presenting myself ready for work at 7 A. M. I was given—to correct and repair—an old jig that someone had made a mess of, and was notified that a variation of 0.0002 only was allowed. Well, that nearly knocked the wind out of me, as it had been my custom to work within 0.001 inch on center distances; but it was another case of "say nothing and saw wood," and I had the satisfaction of having my work passed all right.

One of the first things I noticed at this place was the absence of emery wheels for grinding lathe and planer tools—these tools, of all shapes and sizes, being accurately ground on a Sellers tool grinder and kept in stock in a separate department. When a tool becomes dull it is exchanged for another, and when a tool of different shape is desired it is taken out on a check.

The toolroom is surrounded with heavy wire netting with two openings or windows in charge of two boys, to insure prompt attention. Arbors are kept in bins

separated by small strips; each space is marked with the size it contains and check hooks are attached to these small divisions. The drawings are all mounted on zinc (this beats cardboard mounting) and are kept in small compartments 12x16 inches, with check hooks attached. On these drawings all screws, pins, castings, etc., are marked according to the number and

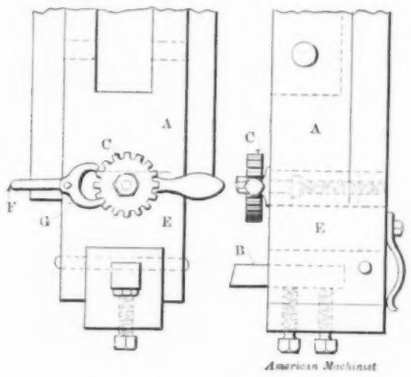


FIG. 16. SHAPER RAM.

quantity wanted, these numbers corresponding to the stock kept in the stock room for distribution on order from the foremen. Among other useful tools kept in the toolroom are some sizing blocks, and it is a pity that other shops haven't them in use, as they certainly do come in handy for setting your planer and shaper tools to the proper hight and in gaging the keyways made on the slotter, planer, etc.

Their milling department which, owing to lack of space, was moved across the street into another building is operated independently of the main shops. It has its own toolroom with drawings, cutters, cutter grinder, etc., the attendant giving out the proper cutters and drawings for each job, examining the cutters as they are returned and keeping them sharp. The gang mills are used for one job and that job only, and when it is completed the cutters are returned to the toolroom, tagged for that particular job, and placed in a special closet. In this milling department there is a large hot soda kettle for washing the oil and chips from the cutters and work.

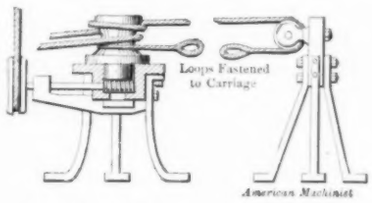


FIG. 17. WINCH WITH ROPE DROVE.

It had been my custom in laying out a jig to use dividers, straight-edges, trams, and the paraphernalia usually employed for this purpose, but I was politely informed—when working on a jig one day—that they did not lay out small jigs in this way, but that they located and bored the holes on a milling machine. Well, who would have thought of doing such a job without laying out the holes? Going up to Tom—who had become quite friendly with me—I asked his advice and got it, and I believe the job was done in about as good a way as was ever thought of.

Of course the jig has been very accurately shaped or planed square, and the next thing on the program is to get an angle plate, clamp it to the milling machine table absolutely square with the table, and butt the jig tight against the plate, clamping it into position square with the table and the arbor of the machine. Suppose your first hole to be 2 inches from the edge of the jig and 3 inches from the edge which is clamped to the table, and also suppose your milling arbor to be 1 inch in diameter. Set a Brown & Sharpe hight gage to read 1½ inches, and, resting this gage against the angle plate and gaging to the arbor, move the table lengthwise until you can just feel the gage touching the arbor. This will give the required 2 inches distance from the end of the jig and the table should be locked in this position. In setting for the hight of 3 inches from the table the performance should be repeated—only gaging from the table and using the vertical screw of the miller. The vertical slide should now be locked tightly in position, a drill inserted in place of the arbor, and the hole drilled

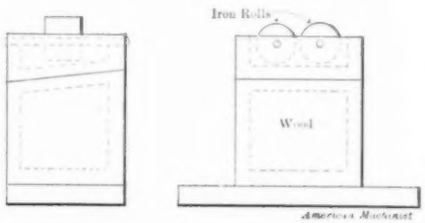


FIG. 18. LEAD SCREW-SUPPORT.

out—using the cross-feed—and then finished to size with a single end cutter bar. To obtain the distances for the other holes repeat the above operations, using the angle plate, table and arbor to gage from as before, but don't disturb the setting of the jig and angle plate. In this manner each hole is drilled parallel with its neighbor, there is no excuse for an error of over 0.0002 inch between center distances if a person is careful that the figures are correct, and it takes only about one-quarter of the time that it took with the old way of laying out the work.

In the Sellers planers the racks are cast solid with the table and the teeth are then machined out. In Fig. 15 is shown a special machine for doing this work, Fig. 16 showing the ram and feeding device. This portable slotter or shaper is fastened to a large platen which is imbedded in the floor. The planer table (shown dotted in in Fig. 15) on the under side of which the rack is to be cut, is set upon this platen parallel to the face of the machine and backed up against two large angle plates. The forming tool *B*, Fig. 16, is automatically fed into the rack surface by means of a lever *F* which operates the pawl *G* and the ratchet *C*, the latter being attached to the feed screw connected to

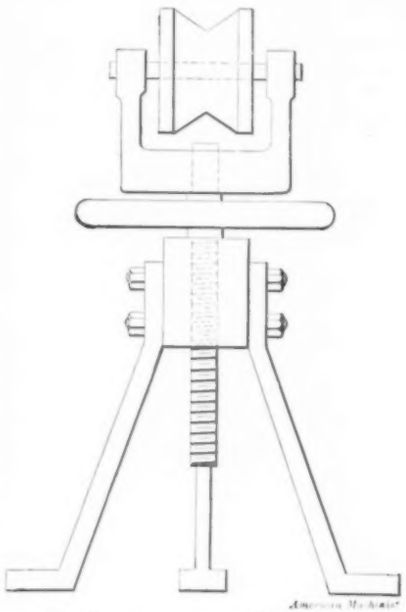


FIG. 19. ADJUSTABLE ROD SUPPORT.

the slide and tool-block *E*. After a tooth is cut to the proper depth, the forming tool is withdrawn and the planer table fed forward one tooth by means of a large screw which runs in a nut attached to the table and has a stationary bearing at the end fastened to the platen. The pitch of this screw corresponds to the pitch of the rack to be cut and one turn of the screw feeds the table forward one tooth. In the spiral geared planers the rack teeth are cut at an angle and this is accomplished with the same machine by inserting taper gibs at the sides of the rail, thus throwing the rail up at the proper angle.

If you ever go into some of the machine-tool shops making large lathes, planers and boring mills you will notice the operations of scraping the heavy carriages to a bearing on the lathe beds, and heavy cross slides to a bearing on the cross rail will be

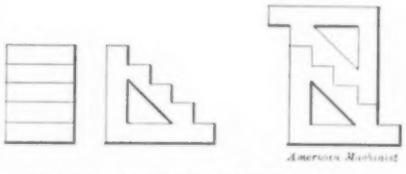


FIG. 20. ADJUSTABLE CLAMP BLOCKS.

accomplished by the aid of a half dozen laborers, who are tugging away as hard as they can pull or push. But in the Sellers shops you will see a power worm-driven winch doing the work operated by one laborer who is taking things easy. This winch is shown in Fig. 17.

In nearly all shops where long lead

screws are cut, a number of steady-rests are used to support the screws between the centers of the lathe. These rests have to be removed and replaced many times during the day as the carriage approaches and passes, and, oh! how many times you will hear that lathe hand bless the fellow who invented that instrument of torture! But send him to the Sellers shops and he will go home rejoicing and will be sure to ask the boss the next day to make him a steady-rest just like the one he saw there.

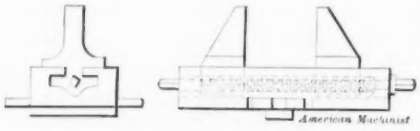


FIG. 21. BORING MACHINE CHUCK.

For those who can't go there the sketch, Fig. 18, will do to show the "Old Man," and he will see at once that this support is much lighter and easier to handle than the regular steady-rest.

Sometimes you may have a long shaft that you want to turn down at one end and you shove it through the hollow spindle in your lathe, but have nothing handy except a lot of boards to support the projecting end. Maybe that adjustable rod support shown in Fig. 19 will be just the thing; the first and only one I ever ran across was at the Wm. Sellers shops.

Among the other handy devices that I saw while there and which would be useful in almost every shop were the adjustable clamp blocks, Fig. 20, for milling machines, planers, etc., the horizontal boring machine chuck, Fig. 21, and the planer tool, Fig. 22, for cutting a keyway in a long sleeve. The sleeve was 5 feet long

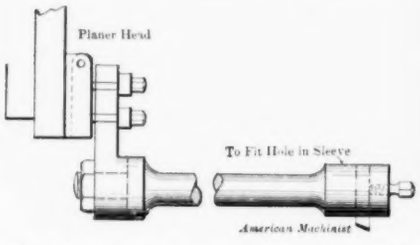


FIG. 22. TOOL FOR CUTTING A KEYWAY IN A SLEEVE.

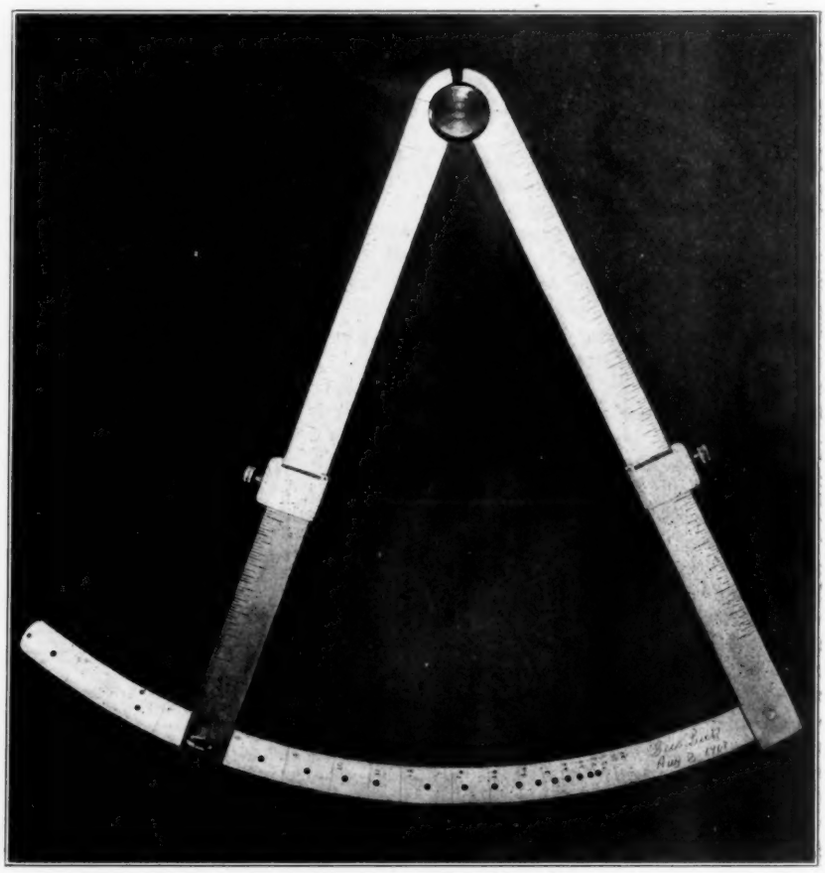
and the keyway half inch wide; the sketch shows the way the tool was held for doing the job.

An Instrument for Spacing Bolt Circles.

The accompanying half-tone illustrates an ingenious and obviously useful tool for spacing bolt circles which has been devised by Mr. Luck, foreman toolmaker of the Milwaukee works of the Allis-Chalmers Company.

In these works it will be understood that bolt holes to all manner of diameters and for almost an infinite number of different spacings have to be laid off. The old inefficient cut and try method of getting the required number of bolt holes on a given circumference has always been a source of annoyance and expense, only partially relieved by tables giving the exact chord required for the cases most frequently used. The instrument illustrated does this spacing in a manner which is almost self-explanatory. If the two sliding pieces are set by the scales to the required radius and then the swinging arm is adjusted on the arc by the pin shown at the point marked for the number of holes required, a pair of dividers set to the center punch marks, which are made in plates of hardened steel, will give at once the chord required.

It is obvious that the graduations on the



INSTRUMENT FOR SPACING BOLT CIRCLES.

arms may be made to give the actual distances to be made to scale, in the latter case the chord being to scale also. For use in shops where it is customary to give the diameter of the bolt circles rather than the radius on the drawings, the scales could be made half-size to give the diameters on the arms and the actual chord required between the prick punch marks. A further use made of the instrument is in the pattern shop where spacings are frequently required. For this use the arms are set with a single shrink or double shrink rule, as is required for the case in hand.

We understand that the instrument will soon be placed upon the market for sale.

An Automatic Combination Piercing, Bending and Twisting Die for Box Corner Fasteners.

BY JOSEPH V. WOODWORTH.

The pieces shown in the half-tones, Fig. 1, are sheet-metal box corner fasteners, used for the corners of light wood boxes and crates. They are produced at a cost so small that they are used instead of nails or screws. The manner in which they are used is shown in Fig. 2. The fastener is held against one side of the box by hand and the points are driven into the wood. The fastener is then bent at right angles and the points in the other end are driven into the other side of the box.

The half-tone shows fasteners of two different types. The longer one has three prongs projecting straight at each end, while the shorter has four prongs at each end, and where in the longer one the prongs are straight, in the other they are twisted to an angle of 45 degrees. Fasteners of this last type are used for heavier boxes than the others, the greater number of prongs and the twist in them making it a much stronger fastener.

The die here shown is used for making the short fasteners direct and complete from a roll of metal. The various operations are accomplished in the "follow" order. That is, first the holes are pierced and the prongs are bent up, then the prongs are twisted to the angle required, and lastly the ends are rounded and a finished fastener is cut off. The manner in which

these different operations are accomplished and the relative location of the means used for each, can be seen in the sectional view, Fig. 3. In this die the usual conditions are reversed, and the "punch" as usually applied is the "die" and the die the punch;

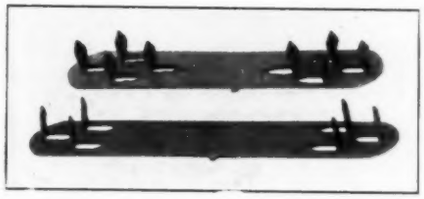


FIG. 1. BOX FASTENERS.

so instead of calling them by their usual names we will refer to them as the upper and lower sections respectively, the section in the press ram being the upper section and the section on the press bolster the lower section.

In the upper section A is the holder, of machine steel. A forging E is the holder and carrier for the piercing and bending die plate I, in which are located the eight piercing and bending dies J and K. The construction of this portion of the upper section is such as to allow the die to descend and strike the metal and then remain stationary while the holes are being pierced and the prongs bent up into the dies by the gang of punches in the lower section, at the same time the rest of the upper section continues to descend and performs the other two operations on the advanced sections of the stock. The portion H, in the upper section, is the holder proper for the die-plate $B\,B$, in which the eight twisting dies L and M are located and the end finishing and cutting-off punch

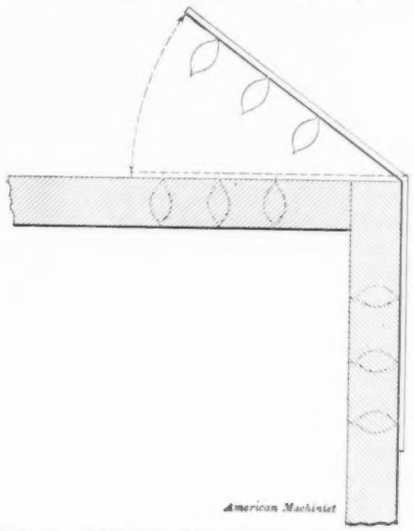


FIG. 2. HOW THE BOX FASTENERS ARE APPLIED.

N. The holder H is held in a dove-tailed channel and permanently located in alinement with the lower section by a large taper pin D.

In the lower section O acts as the die-plate for the cutting-off die $A\,A$, and also as the stripping plate for the eight piercing and bending punches Q and R. These eight punches are located in what might be called a sub-punch-holder located under O in a large hole in the bolster and worked up and down automatically on two hardened and ground steel studs $T\,T$ by a set of connecting levers, as shown in the end

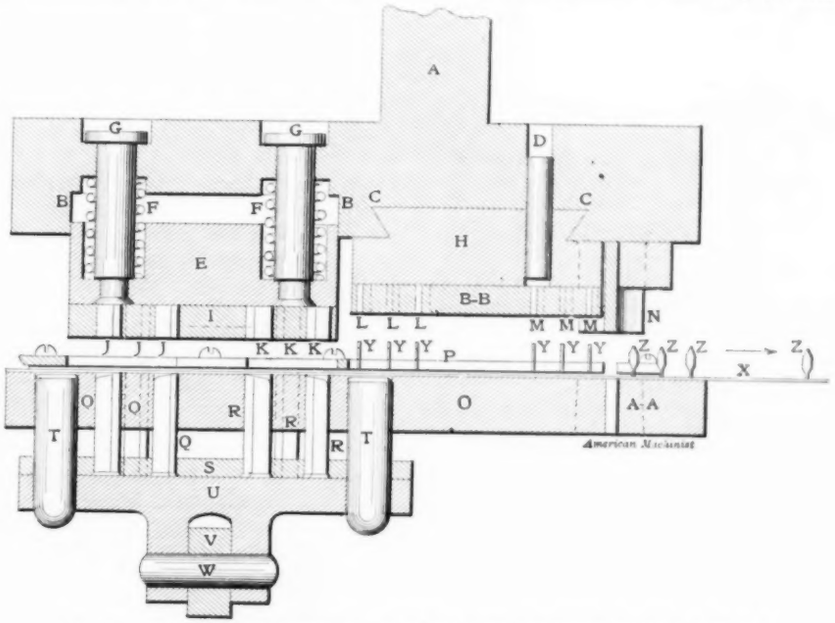


FIG. 3. COMBINATION PIERCING, BENDING AND TWISTING PUNCH AND DIE.

view, Fig. 4. All the parts used in this arrangement are of steel, the holder U and the three levers and bracket (which is fastened to the back of the ram) being forgings. The punch plate or pad S is fastened upon the sub-holder U, by two dowels and four flat-head screws, as shown in the plan, Fig. 5. The die-plates I and $B\,B$ also are fastened upon their respective holders in the same manner. The eight piercing and bending dies are finished with about .003 inch clearance, and the die-plate is hardened and drawn to a light straw temper. The eight twisting dies are simply eight narrow slits which are let through the die-plate $B\,B$ at an angle of 45 degrees with the front of the plate. The edges of these dies are slightly rounded so that the points of the prongs will enter them with ease. The die-plate $B\,B$ is hardened and drawn slightly, so as to leave it as hard as possible. The end-finishing and cutting-off punch N is let into the holder H and upset and riveted at the back. The eight piercing and bending punches Q and R are inclined slightly on the cutting face and the back ends are rounded so that they will bend the prongs up into the dies; the faces of the punches are one thickness of metal shorter than the dies, so as to allow for bending.

The manner in which this die is used for the production of the fasteners with the twisted prongs is as follows: The strip of metal is shown at X, Fig. 3. At the first stroke of the press the eight prongs are pierced and bent upward by the sub-punches Q and R. The strip of metal is then fed along until the eight prongs are in the positions shown at Y, and at the next stroke they are twisted, and the first end of the fastener is rounded and trimmed by the punch N. At the next stroke the finished part is cut off and at each succeeding stroke a complete fastener is produced.

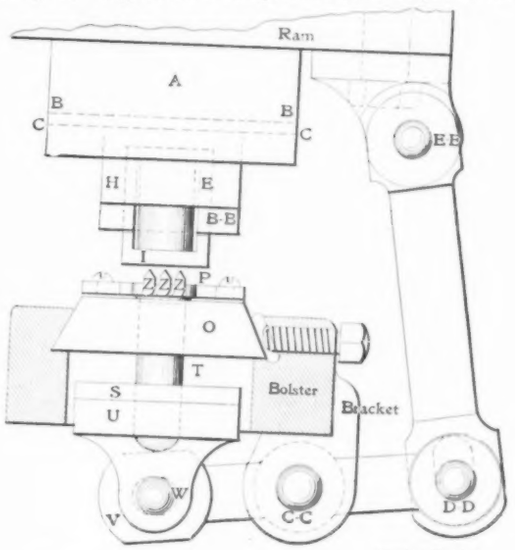


FIG. 4. END VIEW SHOWING SUB-PUNCH MOVEMENT.

A die of the same design as this is used to produce the long fastener. It differs from it only in that there is no twisting operation provided for. The end view, Fig. 4 shows the automatic arrangement by which the sub-punches are worked.

Echoes from the Oil Country.

EXCUSES—A STUDY IN HUMAN NATURE.

Boys sometimes get notions about what is best to be done to help them along, and some of these notions are not very good ones.

A young man walked up to his foreman with the top of a tool-post set-screw, which was broken square off.

"I'll have to have a new screw for my tool-post," said he.

"It looks that way," said the foreman. "How did you break it?"

Evidently the boy was not prepared to answer this, as he replied, "I pulled it in two."

"How long a piece of pipe did you have on the wrench?" was asked.

"I didn't have any pipe on. I just pulled and it dropped off." As the foreman reached and gently pinched his arm to gage the size of his muscle, he added, "I didn't pull so very hard either."

As it was a clean break of a ¾-inch tool-steel set-screw, and as the foreman had seen a 200-pound man swing his weight hard on similar screws, using a tool-post wrench, without their letting go, he somewhat doubted the accuracy of the boy's statement, and so he asked for the other piece of the set-screw, which the boy had taken out and thrown under the lathe. It showed a bend; the tool-post wrench showed a new nick on the outer end and there was a bright spot on the side of one of the chuck jaws. Besides that it seemed odd that a set-screw tightened up until it was pulled in two should be so obliging as to come out without using anything stronger than the fingers. This one had evidently done so, as there was no sign of pipe wrench, dog or chisel having been used on it to get it out; but there was plenty of evidence to show just what had happened.

"Well, son, how did you break that screw, anyhow? You couldn't possibly pull it in two."

The boy got red in the face, looked down on the floor, and blurted out, "There haint no use of me saying nothing. I did tell you and you won't believe me. I don't blame you any for it, for you think I'm lying; and so of course you won't listen to me, and you have a right to think whatever you want to."

"Hold on there; go slow a little. I'd like to think you were a hero like George Washington, who couldn't tell a lie, but here are some witnesses ready to swear against you. Suppose two fellows were to tell you something. Suppose that one you knew was like George and couldn't lie, while the other one could if he wanted to; suppose the story told by the two was so different that you couldn't believe both; which one would you believe?"

"I'd believe the one I thought was telling the truth," replied the boy. "I'd have to."

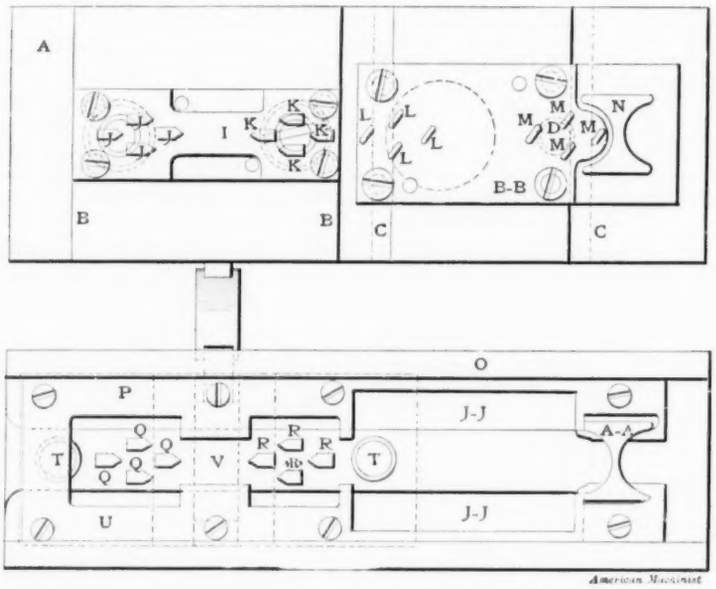


FIG. 5. PLAN OF UPPER AND LOWER SECTIONS OF FIG. 3.

"So would any sensible person. Now, machines are like George Washington: they can't lie if they want to. We may think we understand their language and yet not tell what they really do say, but that is our fault, not theirs. This machine seems to tell a pretty straight story, and it runs about like this: When you put the piece in the chuck and started up and reached for a tool, you started to run the carriage up without noticing that the tool-post wrench was turned toward the head-stock, and the chuck jaw came around and caught it and snapped the screw off. Then you got rattled and scared for fear of a calling down for carelessness, which is your besetting sin. Now, I'm not going to scold you, but I would like to give you a little advice to carry along. You are nearly out of your time, and may need it in your travels.

"It's no use to tell you never to lie. That has to be learned very young to be well learned; but there are some things to remember even in that. In the first place, don't lie when the truth would be in every way better. Don't lie unless there is a reasonable chance of your not getting caught at it; and, above all things, *don't tell a lie that is an insult to the judgment of the one you are lying to.* There is no use of your painting a big sign 'Liar' and pinning it on to yourself. If you will use as much care with your work as it takes to get up a real good, all-wool, fast-color lie, that won't ravel or crock, that will wear well and wash well, you won't need to lie. Now go over to the bench and clean up that lot of shells while Jim makes a new set-screw." And the foreman walked away.

"Gee whiz! but he roasted me proper. You bet he won't never catch me giving any excuses like that the next time something breaks," said the boy to his friend on the lathe over near the bench.

This boy was not particularly bad, but he had a habit of taking things just as easy as he could. If anyone was later than he in getting to the shop in the morning the other fellow got there after the whistle blew, for he made it a point to lie in bed just as long as he could, and it was generally a guess as to whether he would make the shop just before or just after the whistle blew.

To know where to draw the line with a boy, to judge how much he should be censured for his acts, and where he should be only advised and reasoned with, requires a knowledge of the boy's mental make-up and training that foremen cannot always have, and it is often a matter of concern to know just where an effort will land and what the effect will be.

An easy going, good natured young fellow, willing to work, and having quite an aptitude for shop work, drifted in from the country to learn the trade. Without any other recommendation than that given by an uncle and what he carried in his own person, he soon became a favorite with the foreman for his willingness and cheerfulness. He was always willing to stay and help out on any little job that needed to be done after regular hours. He never growled because he got a dirty job, nor hinted that he thought it should have been given to the other boy. If a man on the other side of the shop wanted a lift and whistled to attract attention, he could hear without having to nave a handful of chips or an old nut thrown to help his hearing.

To find a boy with all these good qualities and no bad ones would be expecting rather more than is ordinarily found, and so to offset things this one had a very limited education and an extremely poor realization of the importance of work being right and exactly up to orders. From an outside point of observation it was amusing to see this boy walk up to the foreman and report a bad job and the

cheerful look with which he received a calling down, evidently not in any sense seeing in it any personal application, but merely a part of the performance going on around him, evidently a play in which he was one of the actors like the rest.

The foreman soon saw that talk was much like water on a duck's back with this lad, and had to be very careful as to what work was put in his hands, for fear of results. He had learned by experience that such a boy is much more apt to get a hole wrong in a piece with lots of work already done on it than he is in a rough casting. One day, in a rush of work, the boy was given a piece to drill, and he promptly put the wrong sized hole in it. It being the only piece of the kind on hand and spoiled, it threw back other work and made a loss much greater than the loss of the piece itself.

The boy readily saw and admitted his mistake, listening to the foreman's plaint with that good-natured look that seemed to separate himself entirely from both it and the consequences of the blunder. The foreman, who of course would alone be held responsible for the delay of the job by the office, chanced to look up and see the boy's look, and for once lost his temper and opened up in (to him) a very unusual way, pouring out his wrath on the head of the boy.

First a look of wonder, then of perplexity crept over the face of the boy; finally it seemed to dawn on him that here was something wrong, seriously wrong, and that he was responsible for it, and the color began to come to his face until he was red to the tips of his ears.

The foreman, missing the good-natured comments that usually came from the boy, looked up from the spoiled job to the boy's face, and as he saw the look there, stopped short in his talk and walked away. In speaking of it afterward he said, "It was as though I had started in blowing up a careless boy and looked up and found myself talking to a man, and when I found he seemed to feel it like a man I thought I had said enough and quit, and I never had to go after him in the old way again."

A forging made in a neighboring blacksmith shop was sent in to be finished, and it was given to Ed. It was to be turned so that it would run in the steady-rest, and then it had to be bored out and a square thread, two to the inch, cut so that a screw furnished would be a free running fit.

Presently Ed came around and wanted some instructions about square threads; said this one was his first one and he couldn't just make it work. The foreman found the screw was a very easy fit to start, but after going a short way jammed hard. A little examination showed that the threads were of different pitches. Ed had guessed at the number of teeth in one of the gears and had cut three threads to the inch instead of two, and the forging would have to have a new end.

He did not discharge Ed, but had a quiet talk with him, during which Ed admitted that it was his own fault that the job was wrong and only just that the company should not suffer for it, and agreed to bear the expense of fixing the forging and to fit it up on his own time. "But I never was asked to do that before any place I worked," he remarked.

"Perhaps you never worked very many places before."

"Yes I have. I've been around quite a lot, for a young fellow."

"You must like to run around; you seem like a sober, quiet chap, too. How is it?"

"I'd a good bit rather work steady, but somehow I seem to have bad luck and get fired, or else work gets slack and I get laid off.

"Which would pay you better—to pay for a careless piece of work or lose your job?"

"Well," and Ed seemed to be looking away back over his career, "I guess paying for them would be some in my favor."

Ed paid for that job, and he was surprised that the little blunder cost him a little more than $3 for the forging, besides two hours' time. As long as he worked in that shop he never spoiled another job, and when he finally went elsewhere he shook hands with the foreman and said he wished he had been made to pay for the first job he ever spoiled through carelessness.

"Every time I begin to get in a hurry and slight things I think of those three dollars and can just feel some more crawling away one way or another," said he.

"And if you only knew it, I think you paid more for some of the others than for that one," said the foreman, as he gave a parting shake.

"You bet I'm not going to pay for any more either way if I can help it." And he was gone. W. OSBORNE.

Long Service.

A friend of Mr. Lucas sends us the following note:

"Thomas Lucas went to work for the W. & B. Douglas Pump Works, of Middletown, Conn., December 2, 1847, worked there three years as molder and then became foreman of the foundry, which position he holds to the present time—very near fifty-two years as foreman. He is a very remarkable man for his age and his memory is very good. W. & B. Douglas make about 475 different styles of pumps. Mr. Lucas has charge of the pattern safe, where he can go in the dark or tell anyone where to find a pattern of a certain pump. He has also got out several good ideas in the foundry."

Comparatively few men have the good constitution or the good fortune to be able to work continuously for so long a period.

Letters From Practical Men.

Truing a Belt—High Speed Drilling Attachment—Coiling a Spring—Jig for Drilling Ball Handles.

Editor American Machinist:

Most lathe hands are more or less familiar with belt troubles, especially in shops where the buying is not properly looked after. A poor belt will generally show up its bad points on the cones, as any hump will climb the step and still further hump itself, till it looks like a snake. I was annoyed with such a belt for some time and tried every possible position of the lathe and countershaft to remedy the trouble, but without avail; I had about decided to scrap the belt when the carpenter happened along with his kit to do some repairing. Spying a plane, I held it to the edge of the belt while the lathe was running and took off those humps in short order. The trick did the business, and humpy belts are now conspicuous by their absence.

We lately had some thirty thousand 3-

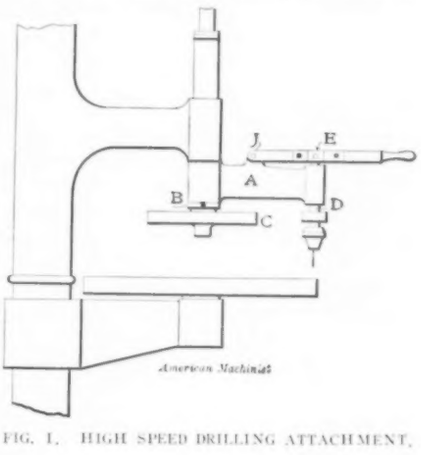


FIG. 1. HIGH SPEED DRILLING ATTACHMENT.

32 inch holes to drill in a number of steel plates, No. 12 gage. We found soon after we started that we had tackled a pretty big job, as we had but one sensitive drill and that would only drill near the edges of the plates. As other means for drilling had to be provided, the large drilling machines were rigged up with a high-speed sensitive attachment, as shown in the sketch, Fig. 1. The rack was removed from the sleeve which was clamped in the machine, and the arm *A* was loosely fitted to the sleeve and held up to the frame by a collar *B*, permitting the arm to swing freely; the pulley *C* was made of a piece of plank and driven tight on the lower end of the spindle. The spindle *D* was a nice fit in the outer end of the arm; the small pulley was driven on, and the lower end of the spindle fitted to an Almond chuck. The top of the spindle was turned down for the thrust collar *E*, which was held in place by a washer fastened on the end of the spindle by a cap screw. The lever was slotted at *J* and two short pins were driven in to

center suitable holes in collar *E*. An ordinary leather belt was used for driving; the small pulley being 1½ inches and the large pulley *C* about 11 inches in diameter, the centers of the spindles being less than 16 inches. The lever was used for swinging the arm and for drilling, the arm swinging through nearly an entire circle. The radial feature was of great advantage as the sheets were so heavy that we found it necessary to use rollers to facilitate rapid and accurate handling.

I have seen several good suggestions for making spiral springs, but will describe a method which I use in preference to all others: For springs of ordinary proportions I take a piece of iron, or any old thing about 1-16 inch less in diameter than the side of the spring required, chuck this with the end of the wire in the drill press, let the wire pass through the hands, holding as tight as possible, and use the tang of an old file to gage the pitch, if an open spring. I prefer a machine with a foot shifter, and would advise a beginner to throw in the back gears till he catches on to the knack of it. I don't recommend

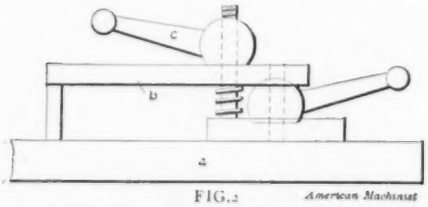


FIG. 2. *American Machinist*

JIG FOR DRILLING BALL HANDLES.

this method for manufacturing purposes, but when a fellow wants an occasional spring he can usually make it in half the time required to get started to make it in the lathe.

We had a few hundred cast-iron ball handles to drill, and, as that number did not warrant the making of an expensive jig, the rig shown in Fig. 2 was employed. A piece of flat iron *a* was bolted to the drill table, which was clamped in position; a hole of the required size was drilled through this piece and it was then bored with a cutter bar to the diameter of the handle and about ⅛ inch deep. This located the handle in line with the drill and with the bottom face perfectly square. Another piece of iron *b*, ¾x2 inches, was then drilled the same size, and countersunk and used as shown, the handle *c* clamping it in position. The piece *b* was case-hardened and showed very little wear after the job was done.

GEO. J. MEYER.

A Driver for Milling Machine Cutter Arbors Doing Heavy Work.

Editor American Machinist:

Mr. Lachmann's description at page 954 of a driver for milling cutter arbors for heavy work prompts me to describe one I made two years ago and which I think is better.

My experience was much the same as Mr. Lachmann's. We mill a large number of V-grooves in cast iron, the included angle being 44 degrees and the depth 2⅝ inches. As the total length of cutting edge is nearly 6 inches and the cutter is 9 inches in diameter, no one will be surprised that on a No. 2 Cincinnati plain miller we twisted the tangs off the arbors.

As we also had trouble to keep the arbor from working out of the spindle, I concluded to make a complete new outfit without these faults, and the result is shown in the accompanying sketches. I had tool-steel forgings made for both the driver and the arbor, which are shown in Fig. 1, from which it will be noticed there are but these two pieces and no screws or other additional parts. The arbor was first turned the full diameter over the driving lugs and afterward planed, leaving the lugs; the driver being slotted for these lugs finished the job and that this driver drives needs no telling. To attempt to get the tang to drive also would be unnecessary. There is abundance of driving power as it is.

The back end of the arbor is tapped to receive the rod which, passing clear through the spindle and having a shoulder and hexagon head, serves to draw and retain the arbor in place.

The use of a hammer (so detrimental to the preservation of truth in machine tools) is entirely eliminated. The arbor is drawn in by the rod and to remove it the collar Fig. 2 is put on the arbor with its recesses opposite the driving lugs; then, filling the arbor with collars, it is drawn out by the nut used for clamping the milling cuters.

The outfit has been used hard for two years and does so well that when we get a new miller with the all-gear feed we hear so much about, one of the first jobs will be to make a good, positively driven arbor for it unless the makers take the hint and do it themselves.

CORNEIL RIDDERHOF.

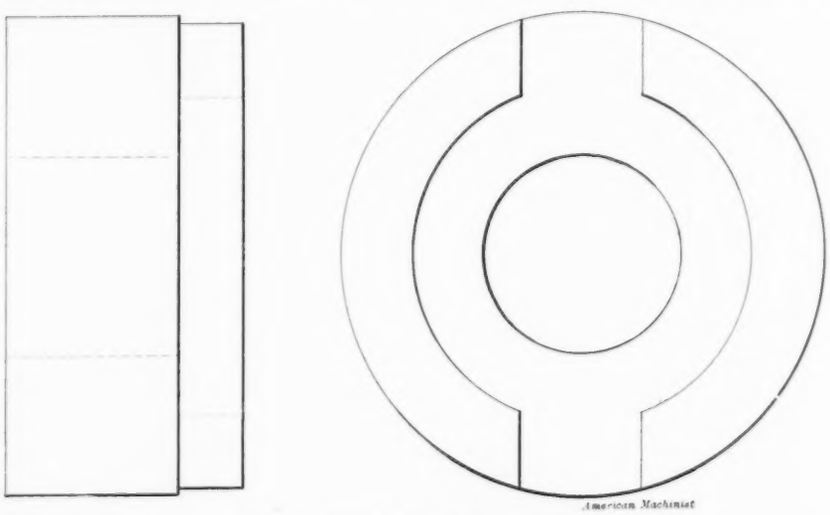
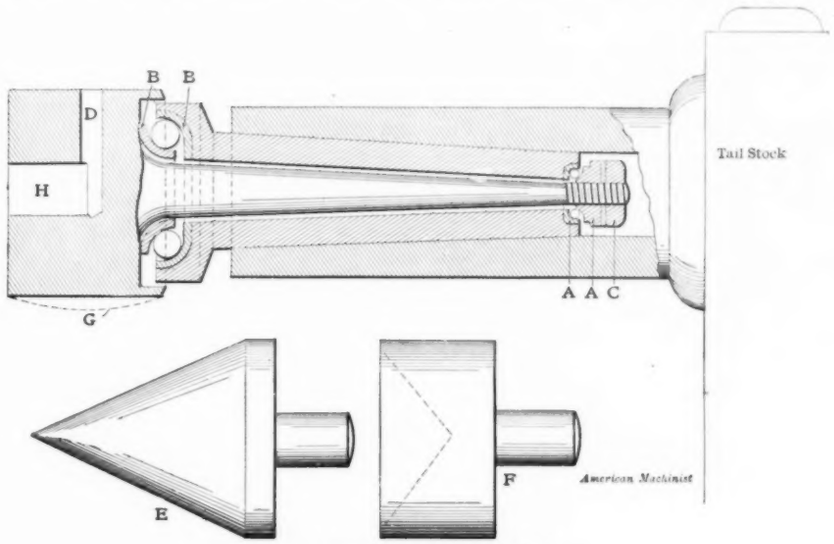


FIG. 2. COLLAR FOR REMOVING ARBORS.

Ball Bearing Lathe Center.

Editor American Machinist:

A ball-bearing center will be found very useful in a bicycle or automobile shop—in fact, in any place where a lathe or grinder is used. Very little attention, however, has been given to the subject by the builders of lathes.



BALL BEARING LATHE CENTER.

The center in the accompanying cut is made of tool steel. *B B* are bicycle hub cups and *A A* are pedal stud bearings separated by a washer from lock-nut *C*. Centers *E* and *F* fit tightly in hole *H* and can be ground in place by crowning the revolving holder—as indicated by dotted line at *G*—and connecting it by a small belt with a pulley on line shaft or with grinding drum. At *D* is a hole for drift-pin for removing the centers from holders.

Care should be taken to select perfect bearings made of tool steel and carefully hardened.

CARROLL ASHLEY.

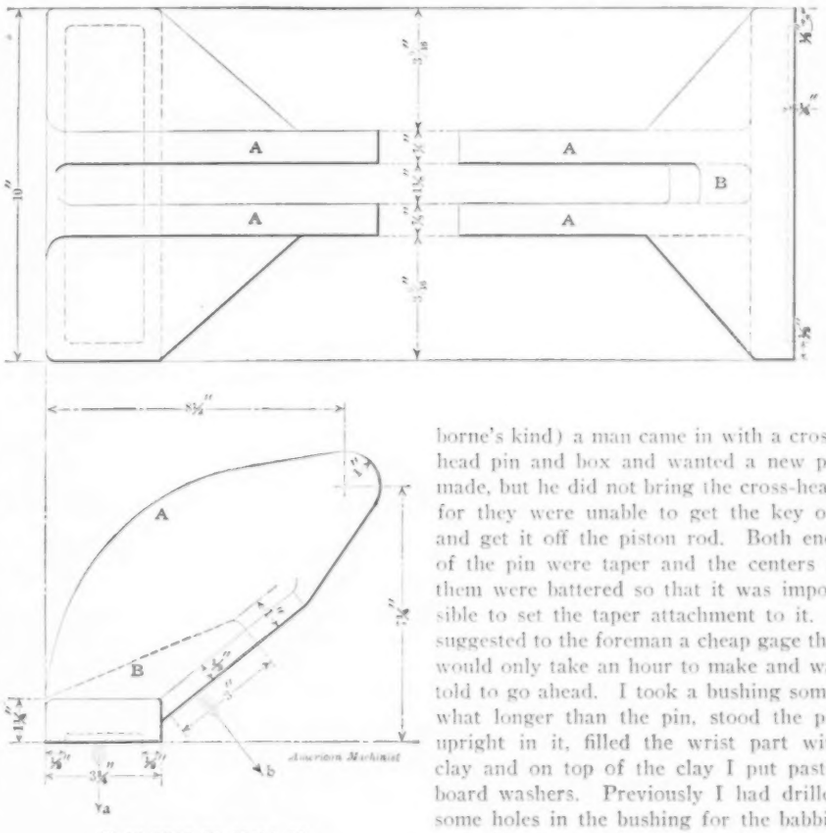
Toledo, Ohio.

Ways of Molding a Grate Lever Fulcrum.

Editor American Machinist:

I send a sketch of a grate lever fulcrum. My object in sending it is to show two ways of molding it. If the pattern was drawn from the mold in the direction of the arrow *a*, there would have to be 8¼ inches in the nowel, and 7¼ inches of that would have to be lifted with the cope. To avoid this, I put the rapping plate so that the face perpendicular to arrow *b* must be laid on the follow-board; consequently, when drawn from the mold, it would have to be drawn in the direction of that arrow. By adopting this way, the molder can use a shallower flask for the nowel, making about 3 inches difference, which means quite a little less sand to handle; also the part to be coped would not be over 2 inches, and could be less if the projecting angle was sunk in the follow-board, which will be understood from the drawing.

It was necessary to give an excess of draft on the right side of the recess, which was only ¼ inch deep; otherwise there was nothing to obstruct the molding. The question arises: when such patterns as here shown have to be made, whether it would be best to put on core prints and enable a comparatively straight parting to be made, using dry sand cores to give the desired form to the casting, or to make a "form" to fit the angle and rest on the follow-board, removing the same before the cope was rammed up. To the pattern-maker who is not in communication with the foundry that will have to use the pattern, it is often perplexing, and the best he can do is to mentally mold it himself. Then there can be some idea formed as to which is best. When it is a green sand lift there have to be "gaggers" inserted, and the extra weight must be considered, especially if it is not to be lifted with the crane. On the other hand, cores must be made, baked, and often the two or more parts pasted together, which, however, is often done by one who does not receive such high wages as the molder. Then, again, will here be few or many castings required? If few, I should adopt the green sand; but if many, then dry sand cores, unless the article would require something beyond the ordinary capacity of core making and drying.



HOW BEST TO MOLD IT.

WM. NEWTON.

A Taper Gage in a Jobbing Shop.

Editor American Machinist:

I have read with interest the descriptions of the different devices for calipering tapers recently shown in your columns, and no doubt some of them are valuable. I would like to describe a simple and cheap method that I am using. Several years ago while I was employed in a jobbing shop in the oil country (one of Mr. Osborne's kind) a man came in with a cross-head pin and box and wanted a new pin made, but he did not bring the cross-head, for they were unable to get the key out and get it off the piston rod. Both ends of the pin were taper and the centers in them were battered so that it was impossible to set the taper attachment to it. I suggested to the foreman a cheap gage that would only take an hour to make and was told to go ahead. I took a bushing somewhat longer than the pin, stood the pin upright in it, filled the wrist part with clay and on top of the clay I put pasteboard washers. Previously I had drilled some holes in the bushing for the babbitt to hold to; then I poured babbitt metal in both, calipering both ends with a micrometer or guessing. Maybe this is old, but I never saw it practiced, so I will hope it may help someone.

CHAS. HEENA.

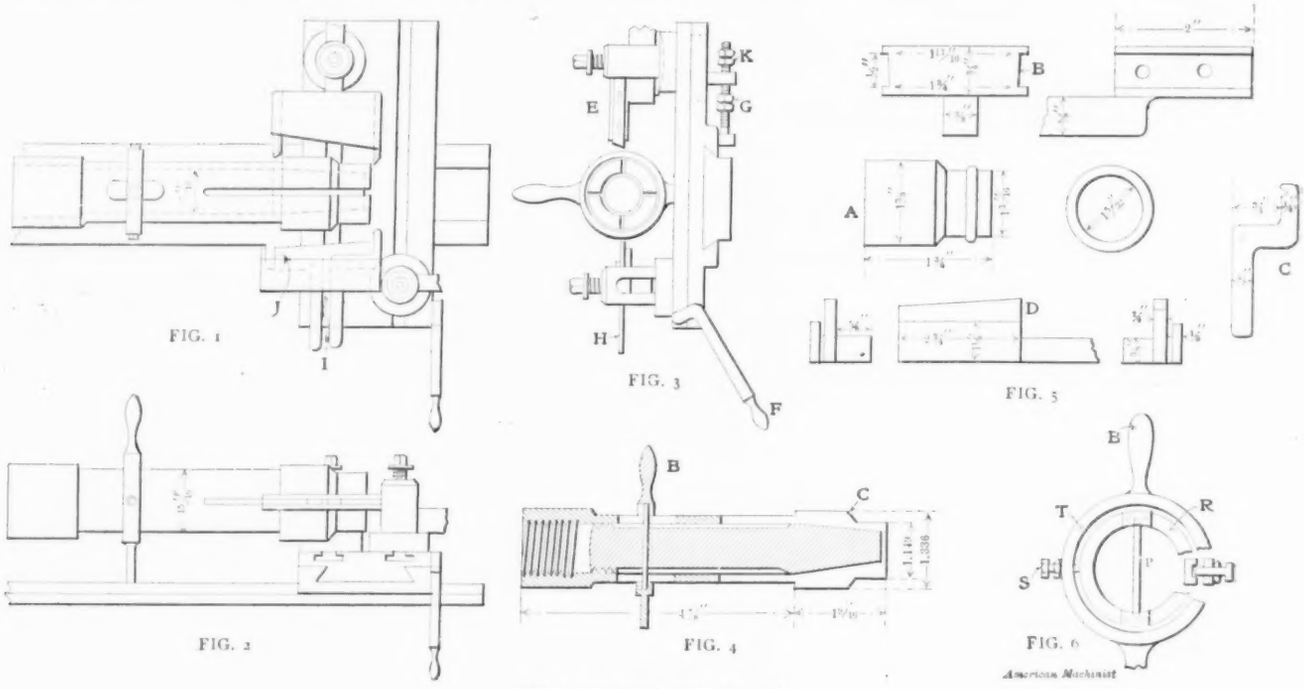
Tools for Trimming Shells.

Editor American Machinist:

The drawings herewith show a set of tools for trimming the outside socket shells for electric lamps. Fig. 1 is a plan of the chuck with the tools in position ready for work, Fig. 2 is a side view and Fig. 3 an end view. The chuck is made of tool steel and is threaded to fit spindle of lathe. It is bored out parallel 7-16 inch to within 1⅝ inches of the end and then has a taper of about 3 degrees. It is turned on the outside .007 less than the inside diameter of shell; thus allowing the shell to be slipped on and off easily. The arbor shown in the section, Fig. 4, is tapered on the end, the same as the chuck, and carries a pin which passes through the slot in chuck and is fastened to a ring revolving in lever *B*. The chuck, which is split up 2¾ inches, is made on the front end, 3-16 inch shorter than the finished shell; this allows room for the scrapers to work. The finished shell is shown at *A*, Fig. 5. The shell is slipped on the chuck and pressed firmly up against shoulder *C*; the lever *B* is then drawn forward, expanding the chuck in the shell and holding it securely while the tools shown at *E*, Fig. 3, are brought forward by pressing down lever *F*. After tools *E* have done their work, lever *F* is raised, carrying the scrapers *H* forward. These scrapers are held open by pressing the handles together, and when the jaws are even with the edge of shell they are released. By means of spring *I*, Fig. 1, they are closed in upon pins *J* and remove the slight burr on the end of shell. Lock nuts *G* and *K* are set to stop the tools and the scrapers in the right position.

The tools for trimming are turned upside down, because they cut on the back of lathe. The holder for tools *E* is shown at *B*, Fig. 5; it is made of soft steel and has a recess cut in each side, the recess being cut on an angle to give clearance to the tools. These tools are pieces of sheet steel, 3-16x½ inch wide, slotted to allow for adjustment and securely held in position by two round-head screws. One of the scrapers is shown at *C* and the holder at *D*, Fig. 5. The shells are put on and taken off while the lathe is in motion. Fig. 6 gives another view of the handle and ring, for operating the chuck. The pin *P* which passes through the arbor and through slot in chuck is fastened into the inner ring *R*. This ring is provided with a groove into which fit the ends of screws *S* tapped through the outer ring *T*. Thus the inner ring is free to revolve in *T*, but when the lever *B* is moved *T* must travel with it. When lever *B* is shoved back it slides ring, pin and arbor back, releasing the shell. Another shell is then put on, lever *B* brought forward and the chuck tightened in the shell.

BARNEY.



TOOLS FOR TRIMMING SHELLS.

A Job Wanted.

Mister Editer:

Dear Sur—Knowin that you hav many frens in machin shops I thot I would rite, askin you to help me git a job. I hav ben workin near hear, in the Rusty Iron Works goin on 7 year. First, I wuz workin round runnin a wheel barow an a boult cutter the las 3 year I have ben runnin the drill press an the smal plainer.

Last month they bilt a pump an Mister R. he sed fur me to go down to the new mill an connec the pump an the preshur tank. He sed to use the short peices of 3 inch pipe, an put in a angel valve, an a flangd cuplin.

I dun as he sed, an about 5 Mr. R. cum round an he cummenced to holler at me an to cuss like no Christian man shuld. I ast what wuz wrong, an he sed I oughter be in them Filipines or in Haidees.

Then he sed I wuz a mullit hed, an a matoyd. He sed I oughter put the valve between the preshur tank an the flange, insted of betwixt the pump an the flange.

Now Mister Editer, how wuz I to no that? I no thair wuz no leeks in enny of the jints.

I dont no what Mr. R. ment when he sed I wuz a mattoyd.

I no I hav always voted Democratic same as him, so I jest got mad, an left him.

So I hope you kin help me git a machinis job, whair the foarman will explane the drafts, an wont expect me to no everything.

I hav enuf tools. Sum I bort, an I hav sum calipers I made myself an a wife an 2 children.

Hopin to hear frum you,

Yures Truly

unser MIKE LUNKHED.

P. S. My reel name is Michael, but all the fellers calls me unser Mike fur short.

Surface Grinding Attachment.

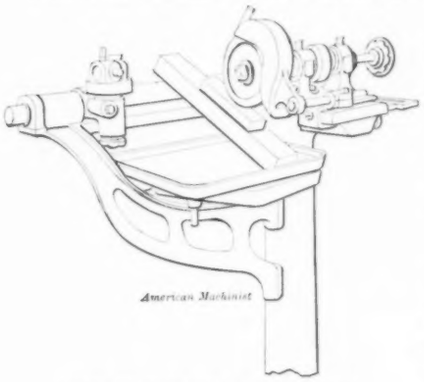
Editor American Machinist:

Enclosed you will find a drawing of a Brown & Sharpe cutter and reamer grinder with an attachment for surface grinding. The attachment consists of a parallel only, the lower end of the parallel resting in the pan and the upper end supported, as shown, by the shield over the bar. Should the work demand more space, the parallel can be laid in the pan with one end elevated a trifle to get the adjustment.

Sometimes it will be convenient to put

a piece of iron between the lower end of the parallel and side of the pan, thus throwing the bottom of the parallel back from the position shown and leaving more space between the parallel and wheel.

I have in addition to the parallel an



SURFACE GRINDING ATTACHMENT.

8x12-inch plate, about ⅞ inch thick, to use as occasion may require.

The illustration shows a piece of steel between the parallel and wheel, the piece being moved of course by hand.

The parallel shown is planed flat on all four sides, and when these sides are worn hollow, as they will be in time, they are planed flat again, as a hollow or concave parallel will produce hollow or concave work.

As the wheel is carried on a horizontal slide, the adjustment is obtained by moving the slide in or out. While it is not an impossibility to run a machine shop without a surface grinder, it assists very materially in the production of flat and parallel surfaces, and the picture shows a good and inexpensive way to arrange one.

According to some advertisements, some things pay for themselves in three months or less, and save 10 per cent., 15 per cent., or even more. The attachment shown (the parallel), I think, paid for itself in three days, possibly in two days. It has been used for surfacing off the planer marks on steel for dies and punches that had to be coppered and laid out; it has ground the dies and punches when they became dull; and it has ground gage blocks, parallels and straight-edges—one of the straight-edges being about 36 inches long.

In running this machine all the operator has to do is to hold fast to his work, or he will find it on the floor. G. SCHNEIDER.

A Test Indicator.

Editor American Machinist:

The drawings herewith show an indicator and some of the ways in which it can be used. The body or holder is a piece of ¼-inch drill rod, drilled as shown at *A*, Fig. 1. *B* is a piece of flat spring steel for pointer, .020 inch thick, and *C* a flat piece .040 inch thick. *D* is the support for pin for pointer to swing on; this pin should be a close fit in *D*. The plunger *E* should be pressed into hole in end of rod *A*. *F* is the plunger pin, and *G* a very light spring, which should have just tension enough to hold pointer up nicely. After the tool is assembled the graduating is done in the following manner: Take a small piece of board, like *H*, hold it in the vise and clamp the indicator to the board with clamps *J*. Next clamp a 2-inch micrometer across the board, parallel with plunger pin, as shown in the cut. Micrometer should be set at zero, and just touching the point of plunger pin. The right-hand end of pointer *B* is left straight and long enough to allow for clamping while graduating plate C.

Now with micrometer at zero, and just touching plunger point, with a light parallel clamp, clamp pointer to the plate *C* and with scriber draw the first line across plate, then loosen clamp and move barrel of micrometer .001 inch, which will move the end of pointer about 1-32 inch, then clamp again and draw second line, and repeat. If careful, the result will be a neat job.

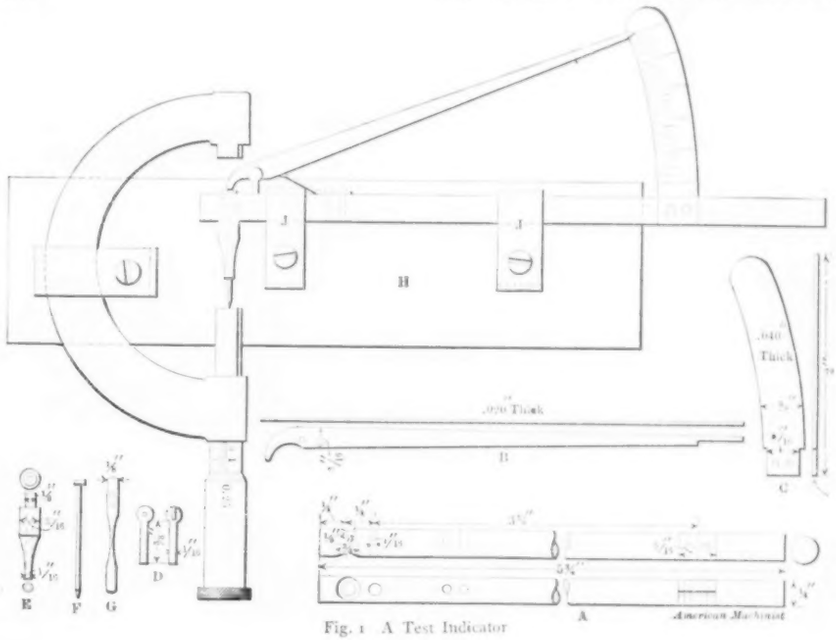


Fig. 1. A Test Indicator.

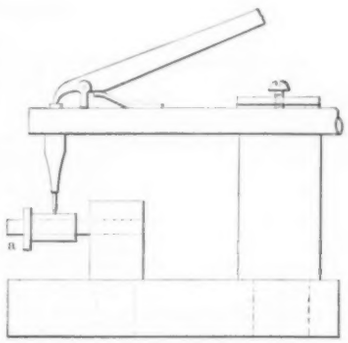


FIG. 2. TESTING A BUSHING.

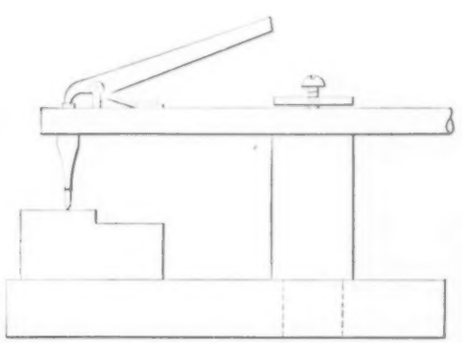


FIG. 3. TESTING A BLOCK.

The writer has been using one of these tools for twelve years for inspecting and testing work, and finds it a very valuable tool where the limit is close.

Fig. 2 shows a fixture for holding the tool for inspecting small bearings, the piece like *a* being rotated on the pin with the finger, or, better still, with the edge of a very narrow fine file. If the piece is out half a thousandth it will show one full graduation on the gage.

Fig. 3 shows a fixture for holding tool for inspecting flat pieces. This operation will show the error in full where, as in testing round pieces, the error is doubled on the gage. W. H. LEHMAN.

Holding Milling Machine Arbors—Piecing a Big Shaft.

Editor American Machinist:

Seeing Mr. Lachmann's article on securing milling arbors, at page 954, reminds me of a little experience I had once in that line. About fourteen years ago I purchased a "Cincinnati" miller (and I presume it was among the first ones made). After using it a short time, and while cutting pinions I found the tang twisted. I simply cut it entirely off, tapped a 5/8-inch, 11 thread in the end, fitted a 5/8-inch rod long enough to extend through the arbor and put a washer and nut on the outer end. The arbor never slipped after that.

When our shop where I am now located purchased a miller, some six or seven years ago, I had the tangs of all the arbors cut off and fixed in this way before using

them at all, and I have never known of an arbor's slipping, though the spindle is often stopped by a heavy cut. The rod also furnishes an easy way of driving out the arbor. I think some manufacturers use this method—think I saw reference to it in the AMERICAN MACHINIST within a year or two.

Thinking about the "peening" discussion reminds me of a case. At least twenty-five years ago I noticed "Tom" attempting to straighten a 4-inch cold-rolled shaft. When I caught him he had a small sledge in his hands while a helper had a steel bar under the shaft on a solid fulcrum. Tom had given it several whacks, but the shaft seemed to grow worse if anything. I said to Tom (he was one of the "touchy" sort), "I'd like to try an experiment." So I brought my hammer—weight, 11 ounces—had the shaft dropped on a block of wood—a little help from the helper balanced it—and in a very few minutes had it "good enough," and only a light hammer to do it.

I think the steel bar used as a "pry" did as much business as Tom's sledge.

E. S. NEWTON.

Chucking Work True—Catching Threads—A Three Cornered Subject.

Editor American Machinist:

I don't believe there is a universal chuck made that will hold work true after six months' use. The best I have come across yet is Taylor's patent spiral chuck, in which the scroll is cut at an angle of 30 degrees, the jaws sliding at the same angle. The teeth are so arranged thereby that the outward thrust is against the solid metal, and this chuck after about two years' rough usage shows an inaccuracy of only about two thousandths of an inch. However, for extremely accurate work this is too much, and it was found necessary for such work to adopt the arrangement shown in the sketches herewith. To each lathe was fitted a chuck back *a*, Fig. 1, these backs all being turned out exactly alike. A quantity of castings *b* were then obtained and fitted to the chuck backs in the manner shown, so that they would be interchangeable on all the lathes. Enough of these castings were fitted up to cover all standard sizes.

It is evident that if these chucks were bored out so that work would slip on easily when it was clamped up by means of the screw *c*, it would be a little out of truth. To overcome this, it was found necessary to bore the holes a tight fit to the work and fit a wing screw *d* for the purpose of opening out the hole to get the work in.

To take odd sizes of stock, a number of castings were kept on hand for boring out as required. These castings were rebored when needed for larger jobs, and were thrown on the scrap heap when they became too weak for further use. Of course, before they had actually become useless they had more than paid for themselves, for by their aid some classes of work were handled much more conveniently than they could have been by the usual methods. Take, for instance, narrow collars or lock-nuts. It is customary to turn these on an arbor—plain or screwed, as the case may be—after boring, or boring and threading the hole, and it is hardly necessary to say that it is extremely difficult to get them true; for either will the hole be expanded by driving in the arbor, or, if threaded, the angle of the thread will throw the work wholly to one side, and the hole will then be eccentric with the outside when turned. In the north of England (Yorkshire) it is customary to turn lock-nuts—after threading

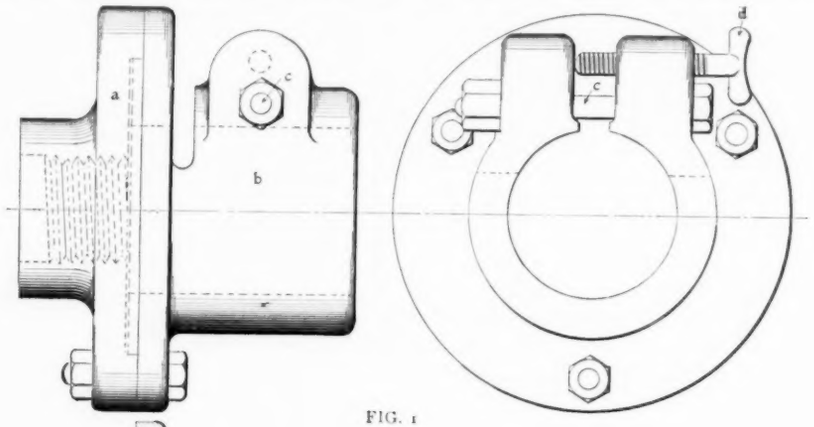


FIG. 1

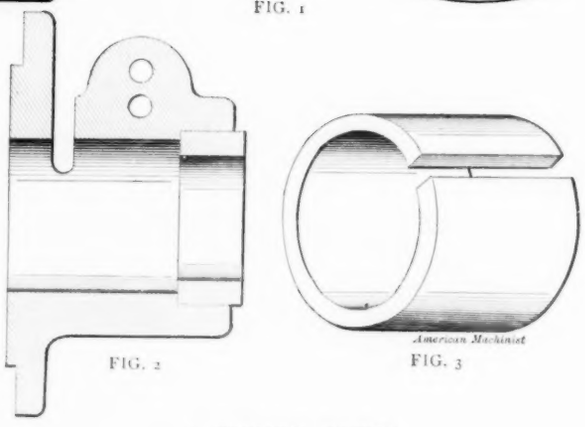


FIG. 2 FIG. 3

A CHUCKING FIXTURE.

—on a taper thread arbor, and in this connection I can relate a story.

We had bought a 20-inch swing screw-cutting lathe—a real Halifax stager. It was what we call a "10-inch self-acting sliding, surfacing and screw-cutting lathe." It had a gap bed 14 feet long, weighed 50 cwt., and cost £43 (about $206)—less than 4 cents per pound. One of the first jobs we had to do was to make some square-thread screws, 10 threads per inch, left hand. I got everything ready and made a start. After running down a time or two with the square-thread tool I noticed the thread appeared drunken. Thinking that I had set the tool incorrectly and that lack of clearance on one side caused it during the first cut to make a false path, I put in another blank, reset the tool and tried again; but, do what I could, the lathe would make a drunken thread. Then it occurred to me that the fault must be in the lathe itself, and I set to work to make an examination. I first tested the spindle but could find no end play there. The change wheels were cast ones, and I thought they might be the cause of the mischief, but after considering that it would take a lot of error in the wheels to make the difference shown in the threads, I decided to look elsewhere for the trouble and examined the lead screw. This screw was slightly bent, and it was possible that in wabbling it might be rocking the saddle backward and forward. But this idea in turn had to be given up, and a solution sought in a probable error in the lead of the screw. After testing, we found this error too small to be considered; furthermore, had the lead been out, the error would have shown in every thread on the work. This lead screw was half-inch pitch and the error in the work showed itself repeated every half inch. While making the detailed examination I had noticed that the right-hand leading screw bearing was heated, and I now decided to take off the lock-nuts to put the thing right. Upon doing so, I noticed that the face of the bracket showed that the friction washer which was keyed on behind the lock-nuts had an uneven bearing. It was found eventually that the face of the bracket was not square with the hole, and the lock-nuts themselves were out of truth. In cutting left-hand threads the

pull of the lead screw drew the lock-nuts up to the bracket, and the uneven surfaces caused a slight end movement in the screw. This of course recurred every revolution, and the error was repeated consequently every half inch on the work. Now, had either of the two surfaces been true, this could not have taken place. Upon asking the maker's workman—who came to put the thing right—how they made their lock-nuts, he informe l us that they were turned upon a taper-threaded arbor and that there was always trouble in getting a true nut.

To make a reliable lock-nut or collar, first bore out roughly to something under finishing size, drive on an arbor, and turn down sides and across the top—in fact, finish the turning as usual. Then chuck in socket, Fig. 2, taking care that the face goes home against the abutment inside the hole. It is now a simple matter to bore to size and screw cut the hole if desired. For very light work it is not necessary to tighten up the screw *c*.

Upon reading letter from J. E. P. at page 347, it struck me that instead of gradually spoiling, by constantly boring out, the main chuck *b*, it would be simpler to fit into one chuck various sizes of bushings, as in Fig. 3, these bushings to be turned rather over size, then split and forced into the chuck, and the chuck tightened up a little. The hole in bushing could then be bored a tight fit to the work, so that when the socket was slacked out the bush would open sufficiently to permit of the work being put in easily.

Now there is that matter of cutting odd and fractional pitch screws by what you describe as Mr. Osborne's method. As I have practiced the same method ever since I started screw-cutting, about ten years ago, I feel competent to "put a spoke in." In your remarks at page 358 you say: "We understand that this method cannot, however, be applied to work that is of small diameter, because this runs at such a high rate of speed that the little variations of time that are liable to occur would make it impracticable to catch the thread properly, *but on small work it is not so important, as there is correspondingly less time lost in running back by power.*"

I beg to differ from you here. I have cut by this method the English standard ¼-inch gas thread, which is 19 per inch, the outside diameter being about ½ inch; and if it were of a finer pitch and a smaller diameter, I would still employ the same method, even at the expense of speed. For on small work there is correspondingly *more* time lost in running back by power, for the lathe takes just as much time to reverse; while in racking back the time required is so little as to hardly be reckoned. Another point is this: Unless you have better means of driving in America than we have here, you can't depend on stopping the tool just where required, and one would have to be very skillful to stop dead up to a shoulder, without opening the nut. In fact, the smaller the diameter and greater the speed the more chance there would be of having to finish the last portion of the thread by pulling round by hand. At the same time where the leading screw is of fine pitch—say, 6 or 8 per inch—I agree with you that it would be impossible to correctly gage the distance to run back unless one racked back to a fixed stop every time. But Mr. Osborne referred particularly to coarse-pitch screws.

At page 353 is an account of a "three-cornered job." Suppose Jones had centered that arbor with a blunt three-cornered center-punch and mounted it on a sharp center, that arbor and the mounted bush would rotate in a three-cornered manner, and a three-cornered job would result. It is surprising what ingenious work can be turned out when not required, and yet when required what elaborate preparations have to be made. This three-cornered job is an example.

Another case in point: Suppose one required a shaft about 2 feet long by 1 inch diameter, round at one end and gradually merging into an octagon shape at the other end. I presume the tackle which would have to be made would be distinctly original. The tackle that did a job like this was very distinctly original, consisting, in fact, of an ordinary back stay, offset centers and a few turnings. The turnings got stuck on the shaft and reaching the back stay caused the tool to dig in. In this way the shaft, which was round at the end where the cut started, gradually became eight-sided.

FRANCIS W. SHAW.

Birmingham, England.

A Pattern Letter Mold.

Editor American Machinist:

I send a sketch of a lead pattern letter mold. In making the mold use good, clean-cut letters—brass letters preferred. The wood part or mold frame is made of cherry wood, and the mold of sifted plaster of Paris. Make the frame good, true and strong and you can have at any time on short notice a mold that will turn out very satisfactory lead letters. Don't ask an apprentice boy to make the mold frame or mold, but when the mold is made you can keep him busy pouring the molds and trimming letters.

A is a cherry board, 1 inch thick, perfectly true on the letter face; *C*, a stiffener on the end. Shellac *A* and then put the letters on in the usual way. *B F* is a box frame, the sides about ½ inch from the edges of the letters and 1 inch deep. *R R R* are runners from gates *G* to the letters. Cut the runners in with a chisel after the mold is made, about 3-16 inch wide at the gate, tapering and just large enough at the letter to allow the mold to fill without chilling. If the mold does not fill, the cause is that the runner is not large enough. Place a piece of wood, as in Fig. 3, tight to the face of the mold and pour in melted lead, then shake out and trim. To melt the lead use a large spoon and heat with an alcohol lamp, placing small pieces of lead in the spoon. A little frame to hold spoon and lamp can be made and kept for the purpose. If the lead does not melt fast enough, put a small piece of wax in the spoon. After the lead is melted skim off the dross and then pour.

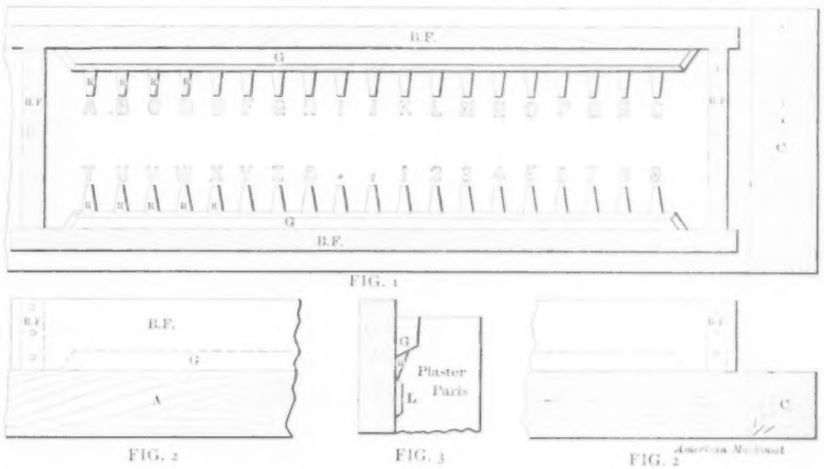


FIG. 1 FIG. 2 FIG. 3 FIG. 4

MOLD FOR LEAD PATTERN LETTERS.

DAYTON.

Sawing Copper—A Narration of Shop Experience.

Editor American Machinist:

Those who have not tried it may think there is very little to be said on this subject; others who are in the habit of seeing it done every day may take it as a matter of course. I found enough in it to keep me interested, and some of the time very much so, for a period of several months, and when at last I got it down to a practical working basis and looked around to see how it was done, I found I had someone to thank for nearly every point of any value that we had gained.

To begin at the beginning, I was working in a small shop building dynamos and motors, and we had to have commutators. A firm in Pennsylvania supplied commutator coppers sawed into any number of

parts required, but their price was high; and it took more time to get them than we liked, and sawing them seemed a very simple thing. We had a good universal toolroom milling machine, and I could see no reason why we could not saw them as well as they. A local brass foundryman agreed to supply us with all the sound copper castings we wanted at a reasonable price. There were times, I think, later when that foundryman wished he had not made any such rash agreement. Some of the copper castings that he made for us looked perfect, but when we came to machine them they would show up all sorts of bad places, and often we would not find them until the sawing was all done; then of course we had lost all that work and he had lost his work and the chips. There were other times when every casting came perfect.

It was copper sawing that I started to tell about, and to illustrate I will take one of the simplest ones, Fig. 1. That's the way they looked when the copper people sent them to us—just enough left at the bottom of the cut to hold them in shape, never more than 1-32 inch. It was a simple matter to finish them with a hacksaw and trim the edges with a file. Now, I had served three years with a first-class tool

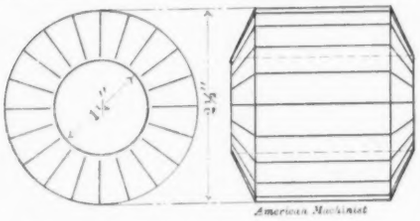


FIG. 1. A COMMUTATOR TO BE SAWED.

shop and had a few years' experience with general machine shops, and I thought I knew what could be done on a milling machine and I determined to try it. We had a German, a good all-round toolmaker of many years' experience; he thought with me that it was only necessary to go about it to do it. Accordingly he was set to work with common metal slitting saws and he managed to saw some of the small ones, but before the first one was done it became evident that we had something to learn.

We divided our attention between speeds, feeds and lubricants. We even went so far as to try milk to keep that saw cool, but it worked no better than oil, and after a few days the smell caused us to drop it; and any way we would the saw would get stuck once in a while and nearly always that meant a commutator spoiled. In the course of a few weeks we got settled down to this: By running the machine at its fast speed and extending the feed cones out with wooden steps, to get a very fine feed, and using plenty of sperm oil we could saw the small coppers fairly well, although we might spoil one once in a while and the time it required to do it was not very satisfactory.

Here was where the matter rested for several weeks, until one day the owner of the shop called me into the office and told me that he had learned the secret of sawing copper. It seems that he had met a man from the saw shop where our Pennsylvania friends had their saws made. He told him they were using a 5-inch saw with ten teeth to the inch, that they were soft enough to file, and, last but not least, they run them 3,000 turns a minute. I gasped once or twice, but my ideas thus far had all proved of very little use. I had to talk and think some time, however, before I could make myself believe any such saws and speeds as that could be used on copper. I started upstairs to see my German friend. I sprung the 5-inch saws at 3,000 turns on him. He gasped at least as bad as I did, and when he got his breath he said "three thousand revolutions!" in a way that would have to be heard to be appreciated.

It was plainly impossible to run that milling-machine head 3,000 turns. The outcome of it was that we took down the countershaft and put in its place one long enough for a third pulley outside the hanger on the front end. We balanced the shaft with the pulleys in place. The spindle and cone of the milling-machine also were carefully balanced. While this was going on, a 10-inch saw was ordered with a 1-inch hole for the arbor, also a large pulley to put on the main shaft and some belting to connect it with the small pulley on the front end of the counter. We made two cast-iron flanges 8 inches diameter to hold the saw as stiff as possible. When everything was ready the saw was started at about 800 turns and the fine feed, and then we commenced to saw copper. To be sure the oil flew from that saw in a way that was not nice, but the saw walked into that copper as if it meant business, and we all felt good for a short time. It was a short time only. Very soon the bearings in that head got so hot that we had to stop, and further investigation showed that the countershaft bearings were nearly as hot as the head. Then there was a period of adjusting bearings and flooding with oil and trying again. The outcome of this was that we got a smaller pulley for the main shaft that brought the speed of the saw down to 600, and then by watching the bearings and everything else we managed to saw the small-sized coppers very well and made very good time on them; but it required the operator's whole time and attention and those saws had to be filed and set as often as once a day and it had to be carefully done and took a great deal of time. When we came to sawing coppers with 80 parts, Fig. 2, it was an even chance whether we got a good job or spoiled the copper entirely. This was the commutator to one of our best dynamos and we required one very often, and as there were several sizes very similar we were not entirely satisfied. We talked of buying a machine with a light spindle that we might run 3,000, but that resulted in a fruitless hunt among the catalogs. Then we talked about making one, using the index head and tail, off our milling machine. In the meantime weeks, and even months, were

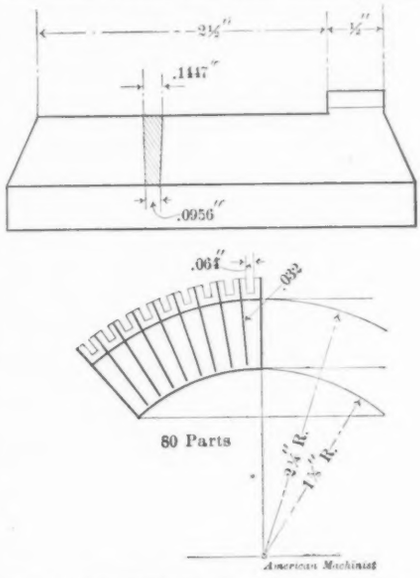


FIG. 2. DIMENSIONS OF LARGER COMMUTATOR TO BE SAWED.

passing away, until one day a friend of the proprietor dropped in. The proprietor was not in, so he came out into the shop. He was interested in all things mechanical and had heard something about our copper sawing troubles. I showed him the saw at work and explained that although it was doing very well on small coppers it would be much better if we could have a small saw and run it faster. "Then why don't you do it?" he asked. I told him the spindle was too heavy for that. He believed that readily, but did not give up at that. It happened that the back gear had been removed from its brackets and that left a small hole, maybe 1¾ inches diameter, parallel with the spindle. He spied it and his next suggestion was to make a small spindle for that hole and speed her up. I said very little at the time, but I began to think right away, and as soon

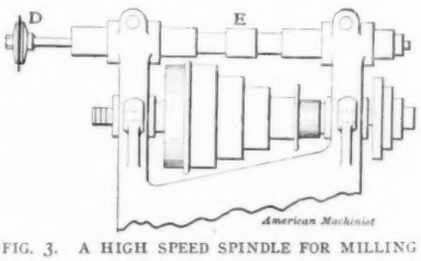


FIG. 3. A HIGH SPEED SPINDLE FOR MILLING MACHINE.

as possible after he had gone I measured that machine up and found that the platen could be raised high enough to allow us to use a small spindle in the place of the overhanging arm; that settled it. The next morning I let everything else take care of itself until I had sketched a suit-

able spindle and bearings, and as soon as possible we made it and got it in place on the milling machine. It was a tool-steel spindle, 1 inch diameter, mounted in bearings in such a way that they could be all taken out together, and when in place it looked like Fig. 3. *D* is a saw and *E* is a pulley. We had several small motors available. One of them was mounted on a shelf on the side of the building and belted directly to the pulley *E;* then, by having several pulleys for the motor and a resistance box in the field

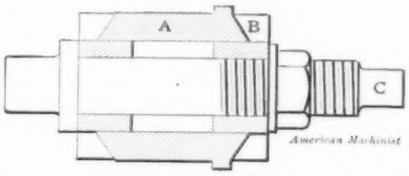


FIG. 4. HOLDING COMMUTATORS TO BE SAWED.

circuit, we could get most any speed required. We had some saws ready by the time all this was done and we started them off at 3,000. They sawed copper to our satisfaction, and from that time on it was a rare thing to have a commutator copper spoiled. We tried various speeds and the faster we run the better it cut, but it also dulled the saw faster at the high speeds, and after a time we settled on a speed of 2,400 turns as the best. Later we put up a special light countershaft and took the motor away. The saw teeth that gave us the best results were almost exactly the shape that a wood worker would file in a cross-cut hand saw that had the same number of teeth to the inch. The set we gave them was very slight, but it had to be there just the same. We kept the saw moist by hanging a can of sperm oil over it. The oil ran down a twisted wire on to a brush of bristles that was arranged to rub on each side of the saw.

Our method of holding the coppers is shown in Fig. 4. *A* is the copper, *B* a brass head, *C* a square-thread arbor. The brass heads were first slotted the required number of slots, with a thicker saw than the one to be used on the copper. They were kept in line by a keyway the whole length of the arbor and a short key in each head. Once we sawed a copper the size of Fig. 2 into 100 parts and made a good job of it. We also used 6-inch saws on some of the coppers with good results. A TOOLMAKER.

Allowances for Press Fits.

Editor American Machinist:

Mechanics trying to find out how much to allow for forced fits must if they look up the literature on the subject get pretty badly mixed.

Elmer F. Tanner at page 804 states that an allowance of one and one-quarter thousandths on an inch in the case of an 8-inch shaft took 100 tons to force on a 10-inch hub, that a shaft 5 inches diameter by 6 inches long having an allowance of 1/1000 inch took 50 tons, and a 4x4 with 1/1000 inch took 25 tons.

We allow 2/1000 to the inch of diameter and up to 6 inches, and have no trouble in forcing in the shafts, with powers ranging from 25 to 80 tons.

Is there not some mistake in the way Mr. Tanner has stated the case, or is the decimal point in the wrong place?

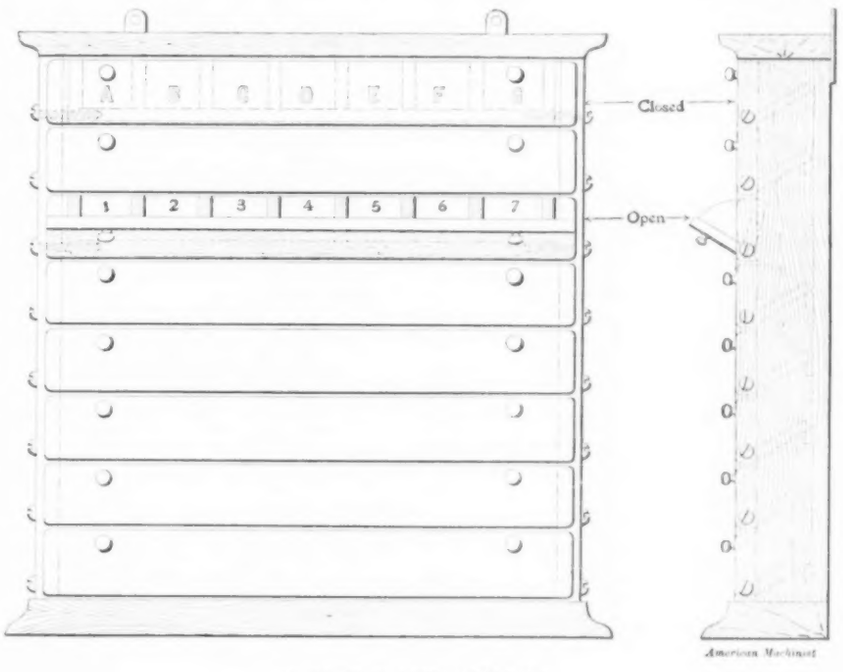
Our shafts are put in to stay and drive without keys. We find this allowance better than any less. JOHN E. SWEET.

[There is, we think, no doubt that many of the apparent discrepancies in this class of work arise from conditions which are not stated, such as the radial thickness of the hub, its length and the material of which it is made. For instance, it has been noted that it takes more pressure to force a driving-wheel axle into a locomotive driving wheel if the tire has been previously shrunk on, other things equal. —Ed.]

A Pattern Letter Cabinet.

Editor American Machinist:

I send a sketch of a convenient, neat and simple pattern letter and figure case or cabinet. A detailed description is not necessary, as the illustration shows the method of construction very clearly. Each length of pockets is hinged on screws as shown. The divisions can be made of 5-16 inch stock and distanced to suit the



A PATTERN LETTER CABINET.

maker. I place them so that three lines will take in a full set of letters and figures. A convenient feature of the case is the ease with which the pockets can be cleaned or the contents removed from one pocket to another, by simply holding under the door, when open, a piece of sandpaper or drawing paper and drawing contents out with a chisel or thin piece of board; also the entire length of pockets can be removed by taking out the hinge screws. The case can be hung on nails or placed on a shelf, and, when varnished with light shellac, presents a neat appearance. It can be used in a supply store or pattern shop. DAYTON.

Suspended Machine Tools.

Editor American Machinist:

In thinking a little of the lines along which our modern machine tools have been developed I sometimes find myself wondering why some apparently very obvious opportunities have been so little availed of, and perhaps in no direction are my inquiring thoughts more frequently directed than toward the advantages, under certain conditions, of suspended tools. This takes me back to my early days in the shop, say in the later fifties, when I was located in what I believe was a good example of the old-time, all-round, jobbing machine shop. There are still some lessons to be learned from the old shops, or there are still some of the old ideas which have not been exhausted of their possibilities. I remember well of course all of the tools of the old shop, and I think I had actually operated every one. Although the shop was not large there was quite a variety of tools, many of them home made, and one of the most serviceable was a suspended drill or boring machine. This was not only a very valuable tool for helping out in an emergency, but it was also handy for the general run of work, and no tool was more likely to be pretty constantly employed. The shop was a rather cheaply built two-story brick building with floors entirely of wood and not too heavy overhead, yet the drill was able to do everything that was required of

it. We would drill large sheets and castings of any size, and when it came to boring we did work that in these days would call for a 12- or a 20-foot boring mill. There was a table under the drill, about the right hight for ordinary drilling, with a place for bushings to guide a boring bar. This table could be moved out of the way and pieces to be bored or drilled could be set on the floor or blocked up in any way most convenient; a guide for the bar could also be located in or on the floor when necessary. Now there is no use at all in wasting time to tell how handy this thing was. What I would like to know is, why we don't see machines of this character more frequently and why the suspension idea has not been more thoroughly elaborated.

I am not in the least advocating here a suspended tool as a makeshift or as a convenience in an emergency, but as actually the best for some lines of work, enabling it to be done quicker and cheaper and "good enough." The increased opportunity for the suspended tool is found in our modern shop construction. A shop with a solid floor and heavy steel columns and beams is very different from an old building with wooden floors only just strong enough for the load carried. We should take a lesson from nature and learn to make things each serve more than a single purpose. How perfectly hull, engine, boiler, steering gear and all the other components of a complete craft are combined in a fish. When we build a ship each functional part has to be compicte in itself and separate from the rest. A floor or a roof of a modern machine shop may be, and should be, much more than that. The building may well take the place of the bases and housings of many of the large tools, so that at the very beginning there is the promise of saving quite a lot of expense. The overhead tool is first of all adapted to large work, to very large work, and especially to work too large to be carried on any of the usual large tools. Say that we had a piece that to be bored would require a 12-foot boring mill, or say one of those mills that you can extend to 20 feet diameter. If we had an overhead boring machine under which the piece could be brought and operated upon we know very well that such a machine need not and would not weigh a quarter as much as the boring mill, and would not cost a quarter as much either. If there were several holes at different positions on the piece to be drilled or bored there would be perfect accessibility, which always has to be compromised more or less when working with the usual machine tools, and then there would be no difficulty about hoisting or moving the piece to position to be operated upon. I am assuming here a solid and level floor with places provided for securing a piece if its weight is not sufficient to hold it, a heavy and rigid system of beams overhead as a part of the building to which the machine would be properly secured, and a machine well designed and properly constructed for good, hard work without coaxing or favoring. I assume that usually there would be little springing or dodging, but removable standards or stays might be provided to connect the overhead frame with the floor and make it somewhat stiffer when nothing was in the way. These stays or standards might often take advantage of holes or irregularities of shape in the work. I do not think, however, that there would be much use for them.

I do not at all see why we should stop with the suspended drill or boring machine. The drill would of course be available for tapping, inserting studs, and work of that character, and it might also be made to carry milling cutters. This leads at once to suggestions of overhead mountings for milling cutters with horizontal or angular spindles, and then why not also have reciprocating movements? A suspended slotter or vertical shaper would be handy in many cases and often save rehandling a large and awkward casting.

It is not difficult to find some reasons why the suspended tools have not made more progress. The shops constructed with the possibilities for their advantageous use are not as yet any too numerous, and no shop designer, as far as I know, has been led to think along this line. The suspended tools are not self-contained and complete and independent, as is the usual lathe or planer or other familiar tool, so no one probably has seen his way to make them and put them on the market or to seek orders for them. I am not ignorant of the fact that suspended drills are in the catalogs of some of the builders, but none have made a specialty of them or tried to show their advantages or in their designing and building shown appreciation of what they may be made to do.

TECUMSEH SWIFT.

Doubts About that Quick Lathe Job.

Editor American Machinist:

"Details of a Lathe Job,' by B. W. T., at page 939, was interesting to me, and if I may say a word regarding this job, permit me.

Everything goes along smoothly in this job until we come to driving the work for the first operation. "If the foreman is up to date" and allows the work to be driven in this manner, by holding the big end in the chuck, he is "more to be pitied than censured," as Mr. Osborne says. "The good workmen know better, anyway." Then comes that roughing cut. It can be done, but I would hate to be the fellow to do it in the time mentioned, and I am sure I would not be satisfied at any stage of the game by keeping the work in the lathe; I would be glad to keep it within five feet of the lathe.

I will stop here; enough said. I don't want to be rude. I have been reading the AMERICAN MACHINIST for ten years and have seen lathe jobs, but this takes the prize for rapid work under the conditions described.

Permit me to say that feed will beat speed on this job, and that the description of the same, if read by an apprentice, would do more harm than good; furthermore, I don't believe there is one lathe hand in three who can duplicate this feat under the directions given.

"TRAMP."

Spring Dividers.

Editor American Machinist:

I send you a sketch of a pair of small spring dividers which I once saw used by a toolmaker where I was employed. I took the sizes to make a pair for myself and as I find them the best I have yet seen for describing a small circle I send the sketch so that others can make them if they wish. The tool is shown in Fig. 1, and Fig. 2 gives the dimensions of the different parts. The piece *A* is made of sheet steel .040 inch thick; it passes through the slot shown in *B* and is a good, snug fit. The slot is filed out perfectly parallel because the fit at this point is the most important part of the whole tool. The piece *A* is flattened at the top for an eye through which passes the adjusting screw, which is 2x48. The end of this screw is a loose fit in *B* and is held in place by the pin. These dividers will make a circle from 1-64 to 5-16 inch radius, but they were made especially for small circles, as they are very rigid and can always be depended on for making a single line, which is more than can be said of the majority of small dividers.

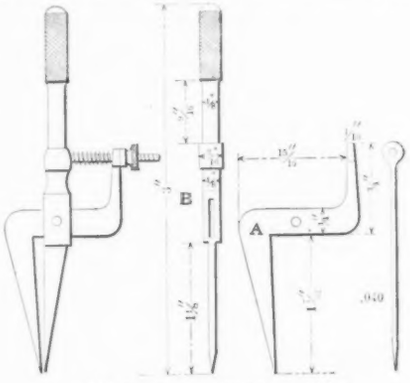


FIG. 1 FIG. 2

SPRING DIVIDERS.

O. G. B.

Tangs for Wood Working Tools.

Editor American Machinist:

"Woodworker" in his communication on the above subject at page 957 suggests the adoption of a standard taper. Any sort of a standard is better than no standard unless it is in itself the worst it can be made, in which case those that are better would be made worse by the adoption of the standard. The whole trouble with the taper shank business is that they were

ever made taper at all; that is, if what is wanted is a tang that when put in will stay. The history of the farmer's hoe ought to convince anyone as to what is right.

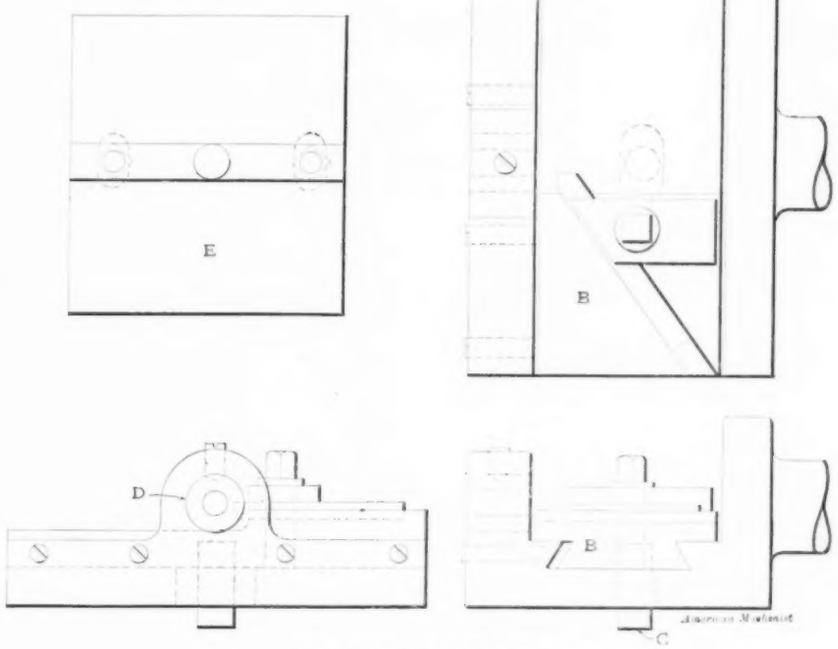
Originally all tangs for hoes and pitch forks were taper, wide and thin, and with an oblong hole to put a horse nail through to keep them from co ing out. The tangs were of such shape that no tool could make a hole to fit and when burned in the charcoal would crumble out; in fact, no one could put them in to stay. In making hoes by a new method the bow and tang were left perfectly round and parallel and the end of the tang pointed a little so as to start in, and when these tangs are driven in a plain round hole and without any fastening whatever they never get loose. It is but another example of the wire nail or parallel forced fit. Since the abandonment of the old sort of tang on the farmers' hoe there has been nothing more ridiculous than the tangs on chisels except files, than which nothing was ever made worse.

Syracuse, N. Y. JOHN E. SWEET.

Taper Turning Box Tool.

Editor American Machinist:

The sketch illustrates a box tool made for turning taper pins on the screw machine. The body of the tool *A* is made of steel and planed out dovetail for the slide *B*. A guide pin *C* is driven into the bottom of the slide. The front of the tool



TAPER TURNING BOX TOOL.

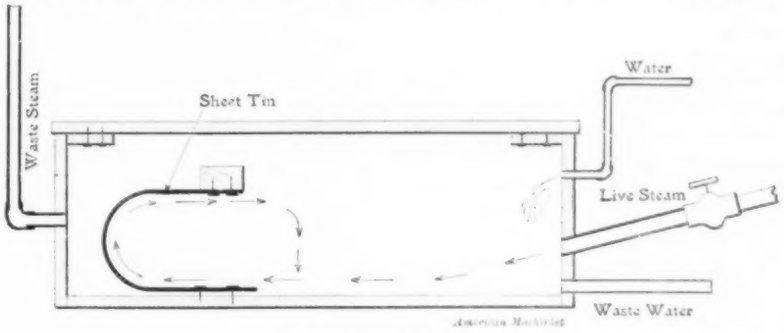
is bored out for a tool steel bushing *D*, which is made to fit the stock to be turned. In turning a pin the box tool passes over the rest *E*, the guide pin passing through the slot in the rest, which can be set to turn any desired taper. E. D.

Washing Overalls.

Editor American Machinist:

The other day I saw a scheme which seemed to me all right, and just to see if it is or not, I send it in. It was in the boiler house of the Union Steel Company, at Honora, Pa., and the credit belongs to Mr. Lewis of that concern. It was a simple automatic scheme for washing overalls—so simple that I did not have much faith in it, to tell the truth.

This machine certainly ate the dirt out of the pair of overalls that I saw it operate upon. The overalls were on the ash pile where they had been thrown from the engine room, and were almost dirty enough to stand alone. Mr. Lewis placed them in his machine, turned on the steam and in ten minutes they were cleaner than any laundry-washed overalls you ever saw. The sketch shows the machine. The overalls are put in and the lid is closed, a fine stream of cold water is turned on, the live steam is started and they are then left to wash themselves. There must not be over an inch of water in the bottom. The live steam strikes the cloth and carries it in the direction of the arrows to the sheet tin. The cloth is compelled to follow the curve of the tin up and around. Then it drops in the stream of steam and water again, and so on. As it works in practice the



FOR WASHING OVERALLS.

cloth is passing around the tin continuously, being kneaded and turned in the hot water until it is perfectly clean. No soap was used, yet no doubt it would have shortened the time. An ordinarily dirty pair of overalls would be cleaned in two or three minutes. It seems to me that where steam is plenty this scheme might be used to great advantage. The box is about 4 feet long, 3 feet wide and 2 feet deep, but could perhaps be made smaller without harm. If too much water is used in the bottom, the steam tears the cloth instead of moving it. F. W. HARRIS.

Pattern Shop Economies—System and Order.

Editor American Machinist:

Having read Mr. J. L. Gard's letter at page 808, I will explain my system of doing pattern work. I have a well-lighted shop and it is kept slick and clean, everything in its place and a place for everything. I have a man to look after the tools, and they must be kept right up to the thing, so that when a man goes to a tool of any kind he knows that it will cut right to his lines. He has not to allow 1-64 or 1-32 inch to smooth his job, for he feels confident that it will come out as expected. I use combination saws, and with a man who knows how to file them they will cut either rip or cross-cut so smoothly that the saw marks are hardly perceptible on the stock.

Another labor-saving tool I have is a 24-inch sand-paper wheel machine with an adjustable table and an indicator to show the angle when used for bevel work or giving draft to patterns. It is surprising to see the amount of work that can be done on one of these sand-paper wheels.

I also have a system of carrying what might be called a commercial stock of glued-up rings for pulleys and gear blanks and similar work. These rings have sawed joints and are carried in stock from 4 to 24 inches diameter and from 1 to 3 inches thick. I have others that are made solid to the center for web pulleys or gears; also I have all sizes of round bosses

in stock ½ inch to 3 inches diameter, from ⅛ inch thick to ½ inch, also pinewood rolls from ½ inch to 3 inches by 1-16 inch. These are made to size, so that when a man wants a boss, say 2⅛ inches, he gets it, and with the rolls the same. He doesn't find them out 1-16 inch one way or the other, but he gets just what he expected to get. All shop supplies are carried in the multiple drawer system and properly marked, such as screws, brads, etc., so that a man gets just what he wants the first time he reaches for it. Rings, rolls, bosses, core prints and such things are in pigeon-holes properly marked as to sizes. All lathe tools are kept in a box with a hole cut in a false bottom to receive each tool right side up. These tools are kept in first-class condition at all times, and it can readily be seen if any is misplaced, so that a first-class man does not have to waste any time looking for some special tool. Drills and bits are in blocks, so at the first glance you can see just what you are after.

Now, what are the results of keeping a shop up to this standard? First, that this ready-made stock can be got out by cheap help, not necessarily by patternmakers; that it can be got out at a small fraction of what it would cost if made as wanted one piece at a time by a patternmaker. Second, there is no waste lumber, as a man can manage to use up all small pieces in getting out stock of this kind. Third, there is a saving of time in making a pattern.

There is hardly a drawing of any size that comes into the shop but what some of this ready-made stock is used. What a

FIG. 1. PATTERN READY FOR MOLDING.

contrast in doing a job of making a pulley pattern, for instance. In most shops a patternmaker would have to get out all of his stock, saw his lags, wait for them to dry after being glued layer after layer. A day's time is gone, or a good part of it, by the time he is ready to turn his job. In the other way, when he gets his drawing he sees what is wanted and goes and puts his hand right on it all ready dry and hard, and his turning tools are where they

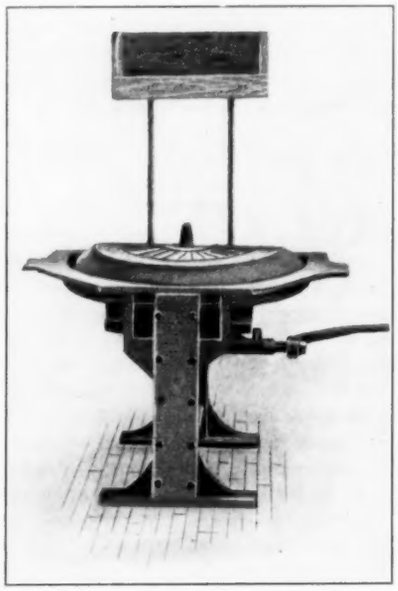


FIG. 2. PATTERN DRAWN AND COPE REMOVED.

can always be found all ready for use. It is surprising to see the combinations that men will make in using this ready-made stock. I fully agree with Brother Gard that there is too much time put on some patterns, and too little judgment used. The making of some of these errors can be charged up to the foreman for not using proper discretion in giving out work; for he should know the ability of each man to do work and the kind he can do the most of. When a man finishes his job it is turned in to the foreman for inspection, and if found all right it is then turned over to the boy to put in fillets, and black if need be. When returned for second inspection, to make sure the boy has not lost any loose pieces or misplaced any of them, the pattern is numbered and a record is made of same by a card system, so that a pattern can be recalled from the foundry at any time.

FOREMAN PATTERN MAKER.

Machine Molding—Mounting a Gear Cover.

Editor American Machinist:

Figs. 1 and 2 are views of a molding machine on which a gear cover is mounted. The first shows the pattern in the right position for a mold to be rammed and the

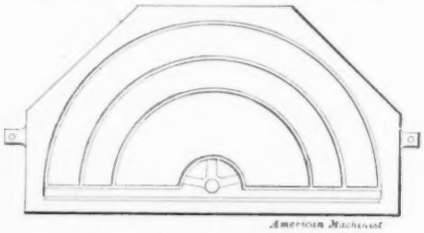


FIG. 3. PLAN OF COPE.

second shows the pattern drawn and the mold removed from the machine. This semicircular cover to be molded is 26 inches long by 16 inches wide and 5 inches deep. The cope is mounted on the stripping plate machine and the drag is worked with a plate. Figs. 3 and 4 are plan and vertical sectional views of the cope part of the pattern, showing the stripping plate and the mold rammed. The cope pattern is prepared ½ inch deeper than the ordinary pattern, and lugs also are secured to the addition *B B*, Fig. 4. These lugs are

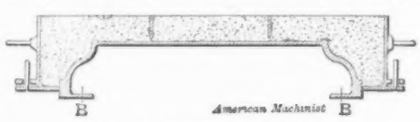


FIG. 4. SECTION OF COPE.

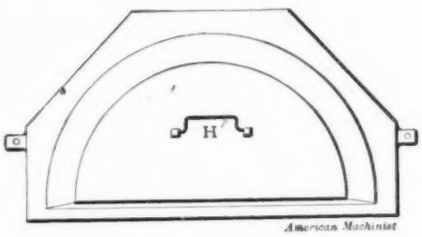


FIG. 5. PLAN OF DRAG.

used to firmly secure the pattern to the sliding head or ram of the machine.

Figs. 5 and 6 are plan and section of the drag part of the mold. Fig. 5 shows the drag rammed up and turned over, ready for the plate to be drawn off the drag. The handle *H* on the plan is fixed on swivels, so that it will turn down and lie

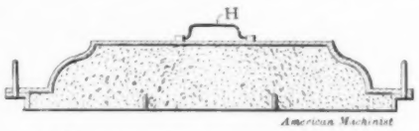


FIG. 6. SECTION OF DRAG AND PATTERN.

flat against the plate when it is rammed up, and it is fixed in the center so that the plate is perfectly balanced and is easily raised from the mold with one hand, the other hand being at liberty to rap the plate, thus enabling one molder to handle with ease a plate which would otherwise require at least two helpers to remove.

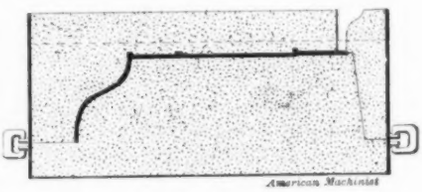


FIG. 7. CROSS-SECTION OF MOLD COMPLETE.

Fig. 7 is a cross-section of the mold complete. The weight of a casting is 28 pounds, and the difference in the output effected by the use of the machine is four castings by machine to one by ordinary methods.

GEO. BUCHANAN.

Molding Retorts of Different Lengths.

Editor American Machinist:

Fig. 1 shows a retort from which castings of different lengths are occasionally wanted, the lengths varying from 3 to 5 feet. The method of molding and preparing the pattern to produce castings of various lengths and also to keep down as much as possible the cost of patternmaking, is as follows, taking a sample order for three castings, one 3 feet long, the second 4 feet and the last 5 feet. The first operation is to place the three drag parts of the flasks on the stove carriage, filling up and ramming them level with the edge and then striking off level. The pattern, which is 2 feet long, is placed on the level bed of the drag and the inside is rammed up. Four rods, cut to the length required, are inserted into the partly rammed up core and driven down until stopped by the plate under the drag. A tube also is placed in the drag and protrudes down through a hole in the plate. A plug is set central in the pattern on the top of the tube, and as the core is rammed up the plug is withdrawn and cinder, free from dust, is filled in. Light cast-iron rings are bedded in at intervals of about a foot to stiffen the core, which of course is made in dry sand. The pattern is rapped and drawn up until the length of core required is obtained, when the pattern is drawn off and placed on the next drag and the same operations are gone through, a staff giving the length of each core.

FIG. 1. A RETORT TO BE MADE IN VARIOUS LENGTHS.

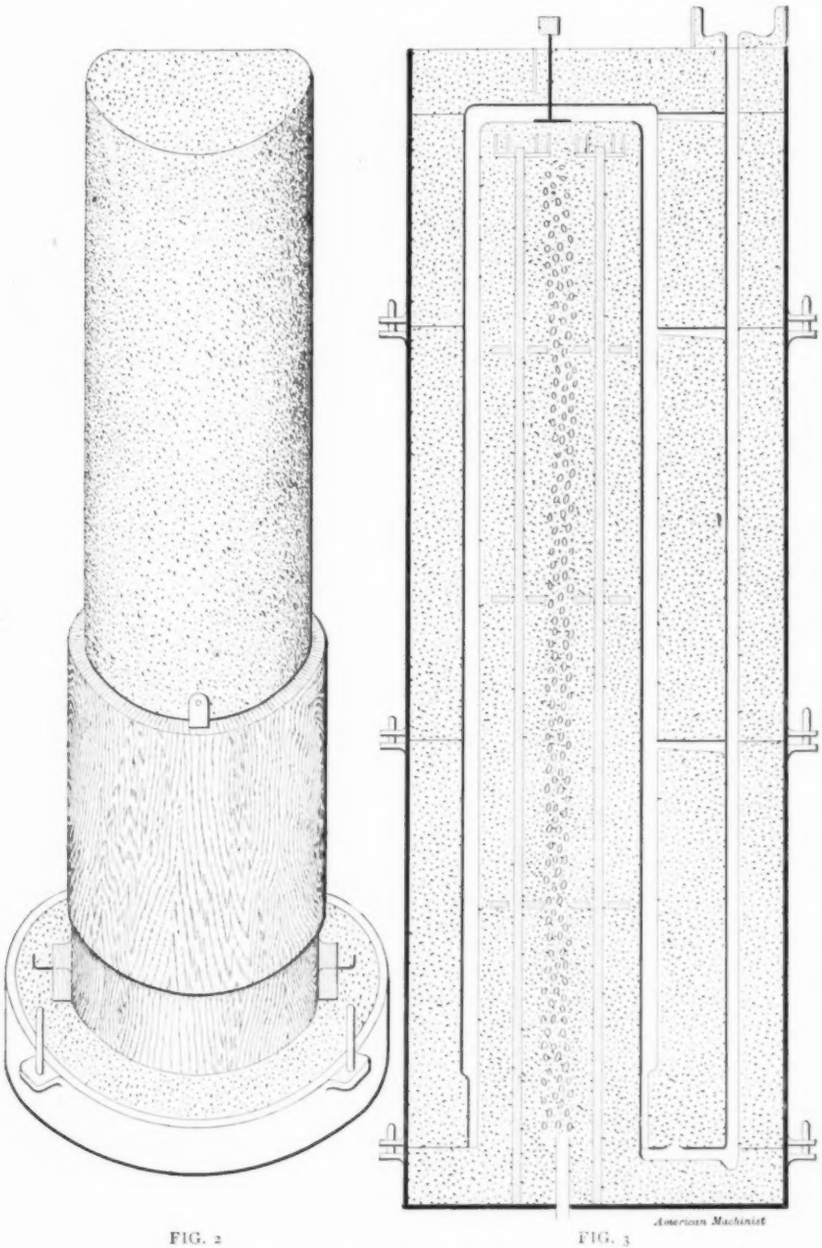


FIG. 2 FIG. 3

MOLDING RETORTS OF DIFFERENT LENGTHS.

The cores (having been dried overnight) are carded and the pattern is made to drop over the cores easily. The cores are next blackened and dried and the pattern is set over the core on to the drag, as shown in Fig. 2. The cope parts of the flask are now placed on to the drag and the mold is rammed up in green sand. An upright gate pin is rammed up with the pattern, one or two partings are made in the cope, and when the mold is rammed to the hight required and the top part lifted off, the cope parts are raised a little at the partings, so that in-gates can be cut, as in the sectional view, Fig. 3. The whole of the cope is now raised from the drag and any loose sand which may have found its way to the bottom is cleaned out, the two slot cores are set into their prints and the cope is set on to the drag again.

This method works well for occasional castings, and a 3-foot casting does not cost more than a 5-foot casting, which is not often the case when working with complete patterns and molding on the flat, the shorter castings being usually stopped off, thus entailing a greater cost for the small or stopped-off casting than for that which is made from the full length of the pattern.

GEO. BUCHANAN.

Wrexham, N. Wales.

Steel Changing Shape in Hardening.

Editor American Machinist:

The article of "Cherry Red" at page 951 on hardening steel is all right and interesting; but it reminds me of an article published some time ago under the heading of "Contraction or Expansion of Steel in Hardening," by "Perseverance," page 209. In this article he refers to an article by "L. O. W.," page 19, in which he states to be an invariable fact what I thought at the time some steel worker would question. To quote from his article: "'The old man said I should have known that steel would contract on hardening,' and he (L. O. W.) calls down the old man quite freely for his other mistakes, but does not contradict him on this one. He is evidently under the impression that steel does contract on hardening. Such, however, is not the case. Again he says: 'Without attempting to go into the theories as to why steel hardens—for all we have on the question is theory'—he proceeds to give us a *theory* as to why steel expands on hardening. His experience may have proved his theory. But my limited experience places his theory on a par with the theory as to why steel hardens—simply theory."

Now, I do not write this article simply to criticise "Progressive," nor for mere fun, but to correct what with some might lead to a wrong impression. When we come to hardening steel we are getting on uncertain ground.

It is hard to guess just exactly what a piece of steel will do when hardened. That it will change its exterior shape is almost certain. Whether it will expand or contract is a question. It is liable to do both; that is, some parts may expand and other parts contract, one offsetting the other, so that its density, or cubic content, or its displacement in water, if the test could be accurately made, would show but little if any change. Perhaps this has all been proven to the entire satisfaction of the scientist, but to the average mechanic I think not, and the thought led me to make some tests in work under my charge.

In making several sets of blanking and perforating dies for seats for mowing machines and other agricultural implements, on which I took measurements before and after hardening, all showed about the same results. Take the larger size, which cuts an irregular circular blank whose greatest diameter is 19½ inches. The die is made of steel set up edgewise and bent to the desired form and in six sections whose total peripheral length is 60 inches. These dies will invariably take up, or shrink, in hardening, ⅛ inch, which is practically .002 to the inch. This will hold good as a rule, subject to exceptions of course. When the punch, which is put up in the same manner and undergoes the same end shrinkage, will not enter the die as readily as before tempering, would be pretty good evidence that a part, at least, of the end shrinkage went into the thickness.

In the perforating dies for this seat blank, there are thirty-two punches, 1¼, 1⅝ and 2 1-16 inches wide and all 7-16 inch thick with round ends. When hardened they invariably shrank in width and thickened in the middle. The shrinkage on these punches in the longest direction showed almost invariably .002 to the inch. So close was it that the one rule applies, and I think it entirely safe to say, for all practical purposes, that what is lost in end shrinkage is made up by lateral expansion. And it is fair to suppose that the steel pin that wouldn't drive after hardening was some shorter, and there is where I think "Progressive" was deceived.

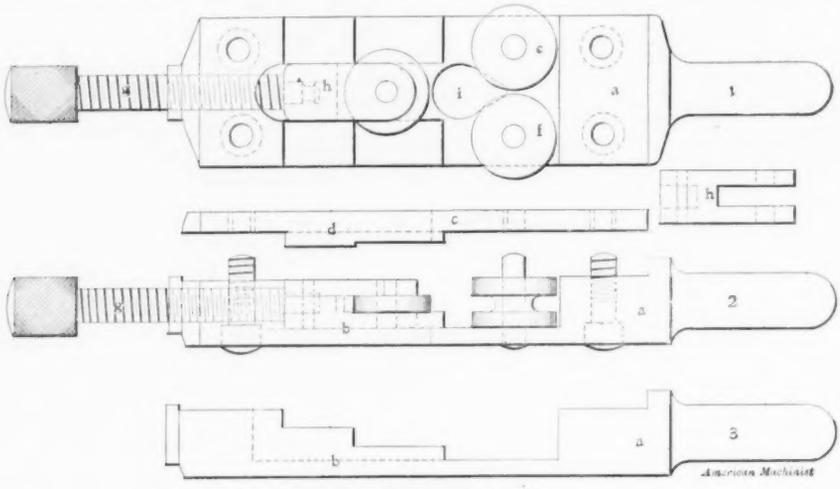
I am not trying to lay down theories or cast-iron rules, but giving the readers a little of my experience with steel.

W. H. CASTLE.

Tool for Knurling Laps to Enlarge Them.

Editor American Machinist:

As several articles have appeared in your columns of late on the use and construction of laps, allow me to contribute my mite to the general fund by describing a small tool we use here for raising the effective diameters of small laps to fit the hole as it is enlarged.



TOOL FOR KNURLING LAPS.

It consists of the piece of tool steel *a*, ⅝x1x4¾ inches, which forms the body of the tool. This is centered and the ends are turned. It is then milled across, as shown in 3, and the center is slotted ⅜ inch wide and down to the dotted lines *b*, 2 and 3. The cover *c* is now milled and fitted in place, and the center of this also is slotted ⅜inch wide down to the dotted line *d*. The cover is now clamped in place and fastened by the filister head screws and the pin holes for the pins which form the bearings for the two stationary knurls *e* and *f* are located, drilled and reamed. The tool is now held on the centers and the hole for the screw *g* is drilled and tapped. The cover is removed and the slide *h* is fitted in place. This carries the adjustable knurl, which is advanced or withdrawn by means of the screw *g* and is fastened to it by a method so common as to need no explanation. The two stationary knurls *e* and *f* are now fitted in their respective places and the cover is again screwed in place, completing the tool.

As a piece of metal when knurled will increase in diameter from .01 to .015 inch, depending on the depth of the knurling, all that is necessary to raise a lap to a larger size is to run it in the speed or lapping lathe and pass it through the opening *i*, which extends through both cover and body of the tool, advancing the adjustable knurl by the screw *g* until the lap is corrugated enough to raise it to the desired gage.

The material for the laps may be either brass, copper or Stubs wire, and they are used mostly for drill jig bushings of a size ranging from No. 46 Stubs wire gage up to ¼ inch. W. E. CALLAGHAN.

Relieving the Hand in Tightening Hand Screws.

Editor American Machinist:

No use trying to fool the editor; I see he caught me napping. At page 955 I had a little article "For Tightening Hand Screws." I meant well, but didn't carry the explanation far enough. I used this tightener for large hand screws only; it can be used on any size. I have glued together numbers of pieces of lumber where it has been necessary to clamp with large hand screws, and after putting on twelve or fifteen of these large screws my hands have been so sore that I could not work with my plane; but to put on as many clamps with this device is like "getting money from the old country." Nevertheless I wish to pay you a compliment. Your editorial note tells me that contributions to your paper must have merit, and your point is well taken that "many threads are stripped without the aid of a lever." B. M.

Laying out Dunbar Packing Rings.

Editor American Machinist:

I send sketch of a rig for laying out Dunbar or similar piston packing. The rings of this packing have each to be sawed into six sections and this lays out the ring for the sawing easily and quickly. The plate is 22 inches in diameter and 1 inch thick, and while it is in the lathe being faced the several circles for the different diameters are cut on the face by

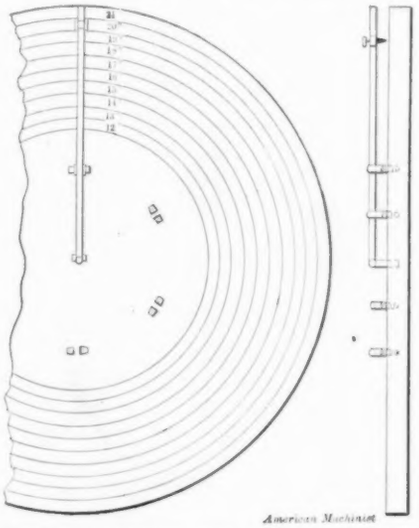


PLATE FOR LAYING OUT DUNBAR PACKING RINGS.

a sharp-pointed tool. There is a hole in the center in which is swiveled a straight bar with a sliding point which does the marking. At six equidistant points are vertically slotted studs and the bar when dropped into one of these slots is in position for making one of the marks on the ring to be cut. When the bar has been dropped into all the slots and all the six marks have been made on the ring the job is done.

H. F. KILLEAN.

Clinton, Iowa.

Tools for Making a Brass Ball.

Editor American Machinist:

By the aid of the accompanying photograph and sketches I will try to describe as clearly as possible a set of tools used in an ordinary engine lathe to make a drilled, counterbored and internally threaded ball (Fig. 2) complete from ¾-inch brass rod stock.

The stock is held in a spring chuck and is set out a certain distance to a gage made for the purpose. The drilling and counterboring is done with a combined drill and counterbore having a shoulder or stop for gaging the depth. The tap holder is shown in Fig. 1. It consists of three parts *A*, *B* and *C*. *B*, shown in section, has a shank fitted to the tail spindle and is bored a free fit for a straight shank turned on *A*. The stop *C* is attached to *B*, as shown, and extends forward and encircles the tap, which is held in *A* by a headless screw allowing it to be adjusted out or in, according to the depth to be tapped. In *A* are driven in diametrically opposite positions, two small, flat-ended, hardened steel pins which interfere with two similar pins in *B*. While the tap is cutting, the operator's forward pressure keeps the pins together and *A* is held from turning. When stop *C* comes in contact with the face of the work, the tap continues forward until the pins disengage and allow *A* to turn. The lathe is then stopped and a short pin placed in the hole *a* and held while the lathe is reversed and the tap withdrawn. If the tap does not bind I do not know but that a knurled place on *A* would answer the same purpose.

Figs. 3, 4 and 5 are respectively a plan, elevation and end view of the forming tool, Fig. 4 being a section on the center line of Fig. 3. This is a modified form of the ordinary undercut forming tool such as is often used in the screw machine on brass work. I take it for granted that the method of mounting and attaching to the slide of the lathe will be readily understood from Fig. 6. The two wedges are for adjusting to hight, which, in the case of this tool, determines the diameter of the ball.

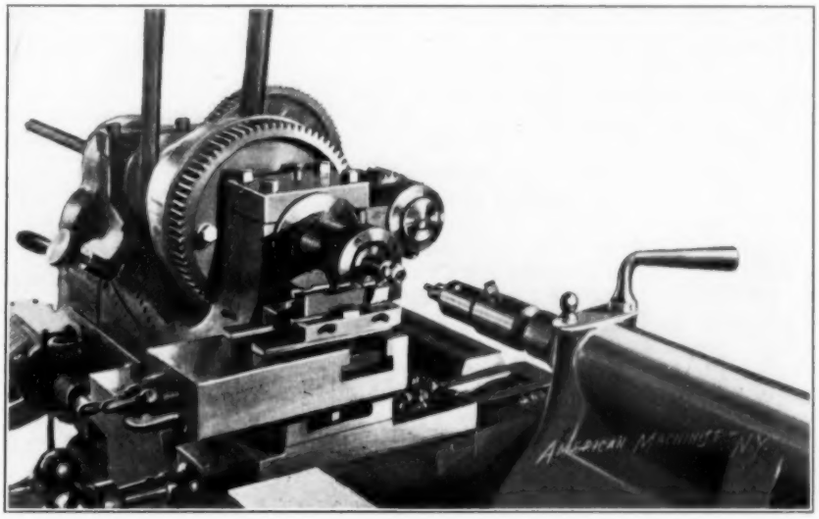


FIG. 6. MAKING A BALL IN THE LATHE.

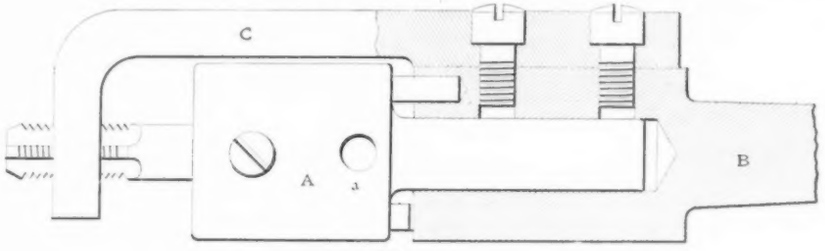


FIG. 1

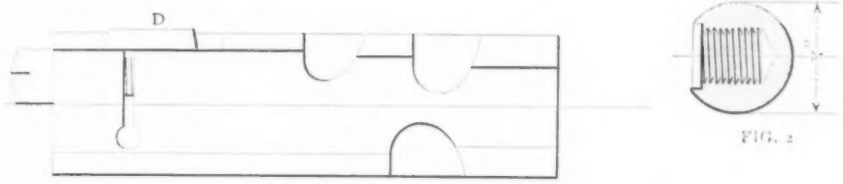


FIG. 3

FIG. 2

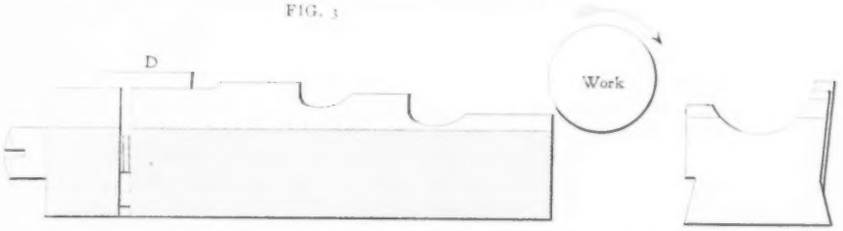


FIG. 4

FIG. 5

TOOLS FOR MAKING A BALL.

From the nature of the construction of the undercut tool, in starting it must cut under difficulties, especially if there is much stock to turn off in places. This may be understood from Fig. 4: the higher the cutting edge the more the scraping action at the start. But when the work is brought down nearly to size, so that the cutting edge is well under the center, the cutting action is admirable; and if the tool is properly made with a perfectly smooth forming surface on top, and ground askew in front, it will—on a broad cut—produce a nice finish free from chatter marks. Moreover, this tool has the advantage that repeated grinding will not change its form.

In the tool here shown the curve of the ball was milled almost a full half circle in the top of the steel. Then it was cut out in steps, each step a cutting edge; the side next the headstock having more cutting edges because it was the higher. The first step has as much of a scraping action in starting in as is allowable. The next takes hold on the reduced diameter in the same manner as the first; the last one leaves a neck about ⅛ of an inch in diameter which the cut-off blade *D* readily cuts away, leaving a ball perfectly smooth with perhaps the exception of a very small tit, which is easily removed.

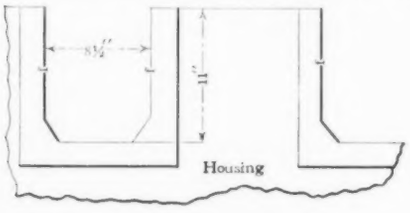
Of course, it will be seen that while the undercut is being made the lathe must be run backward and then forward when the cut-off blade is about to enter.

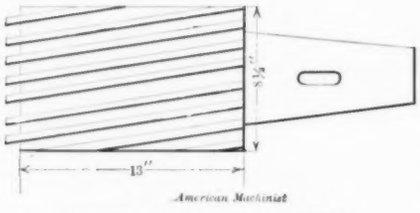
H. B. MCCABE.

Machining the Jaws in Mill Housings.

Editor American Machinist:

I have just completed the operation of milling the jaws in the housings of a roller table for a 40-inch blooming mill, and a brief description of the job may be of interest to persons who use that machine: The milling was done on a Niles horizontal boring and milling machine. The spindle of the machine is 6½ inches in diameter, with a 4-inch taper hole for the milling cutter. I enclose a sketch of a part of the housing and also one of the milling cutter used. The jaws were 8½ inches wide, 11 inches deep and 12 inches long, with over an inch of stock to take out at the sides and from ⅜ to ⅝ inch at the bottom. We had two cutters made, one for roughing, the other for finishing; the finishing cutter had to remove about ⅛ inch stock all around. The first cutter was run through in 45 minutes, the second was run through in 25 minutes and did a very good job. We had eight housings and nine jaws on each one. We ran the first cutter through eighteen jaws before grinding and the second through thirty-six. The difficulty we experienced was in running against the scale on one side, which was very hard on the cutters, but we got along very nicely on the job, and could do it in much less time than on the slotter or planer. The machine was not heavy enough for this





CUTTER FOR MILLING HOUSING.

job, but it proves to me that the possibilities of this tool are very great. We use milling cutters here from 1⅝ to 36 inches in diameter with the very best results.

A PITTSBURGH MACHINIST.

Turning Soft Rubber.

Editor American Machinist:

The following kink in turning soft rubber, such as that on clothes wringers, was unknown to me until recently when a job in this line came into the shop, and I thought the manner in which it was handled would be interesting to some of your readers. To try to turn it as one would turn a piece of metal with a diamond point or a side tool will tend to make one not familar with that sort of thing think he is "up against the real thing," but two simple sheet-metal tools make a very simple matter of it. Fig. 1 is a thin strip of sheet metal ground to a thin, sharp edge; it is fastened to the end of an ordinary lathe tool with any convenient clamp and used as a cutting-off tool to cut the work to length; it is fed to the

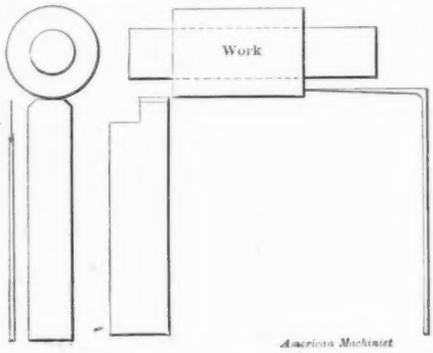


FIG. 1. FIG. 2.

rubber as shown by section. The ends that are thus separated from the roll can be readily torn from the spindle. To reduce the diameter the tool in Fig. 2 is used, starting at the end of the work and feeding longitudinally, cutting a hollow cylinder from the rolls; when a length equaling the capacity of the tool has been cut the chip can be cut away with a knife, and the operation continued. This tool did not leave a nice surface and the diameter was finished to size in a universal grinder.

J. B. S.

Shell Cores.

Editor American Machinist:

In making shell cores there is always more or less trouble in holding the vent pipes just where they belong, even with the use of a gage to locate them. The gage fails to hold the pipe in its proper place, from the fact that it does not hold or support it at all points.

It is especially necessary that the pipe should be in its proper place when the casting is thin, say ¼ inch. If your pipe is out of place ⅛ inch the casting will of course be ⅜ inch thick on one side and ⅛ inch on the other, and perhaps you fail to find it out until the casting is finished and being tested.

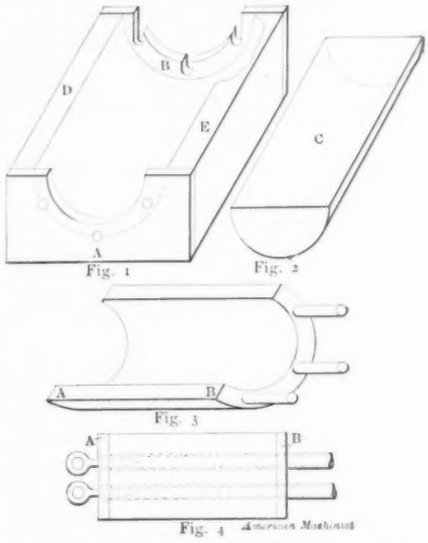
This trouble can all be easily overcome by a very simple and inexpensive device on your corebox. When attached to the corebox it cannot be mislaid or lost like a gage, and it is always there when you want to use it. Fig. 3 shows one-half of a core finished with pipes extending through one end, two of these cores being pasted together to form the complete core.

Fig. 1 shows a corebox which for durability we make solid, instead of in three pieces as usually made. *A* shows holes for pipes for pins; *B*, slots for vent pipes, the ends of the pipes extending beyond *B*. Fig. 2 shows the part of the corebox which forms the inside circle of the core. Fig. 2 being placed in Fig. 1, bringing *C* flush or level with *D E*. Fig. 3 shows pins in the corebox for holding the pipes in position.

Cut off three pieces of vent pipe the same length as the thickness of the end *A* of the corebox. Locate the exact places for the pipes at *A*, Fig. 1 and bore a hole for each pipe so that the pipe will drive in snug, and smooth all off flush on the inside of the end of the corebox at *A*. Now make three pins that will fit the vent pipes and withdraw easily, and so that they will project about 1 inch or ½ inch inside the end of the corebox at A.

In placing the vent pipes in the corebox, first put in the pins as at *A*, Fig. 1. Now put a pipe on each pin, and no matter how hard you ram you cannot dislodge them. When the core is ready to be removed from the box, remove part *C*, Fig. 2, and bed in on a board, still leaving in the pins. Roll over so that *D E*, Fig. 1, will be next to the board. Now remove your pins, lift off the corebox and your pipe is just where it belongs.

Now a few words about your pipes: Be sure they are straight and clear. The time spent in seeing to this will more than pay for itself in good castings. After the two halves of the core are pasted or fastened together, the vent pipes which project above the core are each covered full length with a jacket or hollow core, made so that



MAKING, LOCATING AND HOLDING SHELL CORES.

it will slip upon the pipes easily and with about 3-16 inch of sand all around the pipe, which covers it completely, only leaving the hole in the end of each pipe open for the gas which forms inside to escape. The heat first melts the coating of rosin on the face of the core, the gas then formed passes through the cinders in the core, then through holes in the pipes and up and out at the top.

In putting on these jacket cores, the coremaker uses a little paste to secure it at the top, also tapering them off at the top about ¾ inch at the same time. This is to allow for the easy entrance of the

pipes into the holes in the cope when placing in position. The holes in the cope for vent pipes should be an equal distance apart to correspond with the jacket cores on the pipes and be at least 1-16 inch larger in diameter than the jacket cores, so that the core does not crush when closing the flask.

Since using this method of making shell cores, we have yet to lose the first casting, whereas formerly four or five were bad out of twenty. Of course much depends on the placing of the chaplets, but if your pipes are an equal distance apart or correspond with holes in the cope, it stands to reason your casting must be an equal thickness all around. C. NEIL.

Repairing a Mine Hoisting Plant.

Editor American Machinist:

The hoisting and pumping plant at one of our mines consisted of four 100 horsepower tubular boilers and one 100 horsepower engine. The boilers furnished steam for all the pumps and for the engine which did the lifting of the ore from the mine. The hoisting plant consisted of four drums 6 feet in diameter, 5 feet face. Fig. 1 is a plan of the setting of the drums. The engine had two cylinders with the cranks at right angles and link motion, the pinion on the engine shaft meshing into the two large gears on the drum shafts. The drums ran loose on the shafts and each had a common horn clutch cast on one of the end spiders. On the shaft were corresponding clutches working on a feather. These could be thrown into engagement by the levers shown in the sketch.

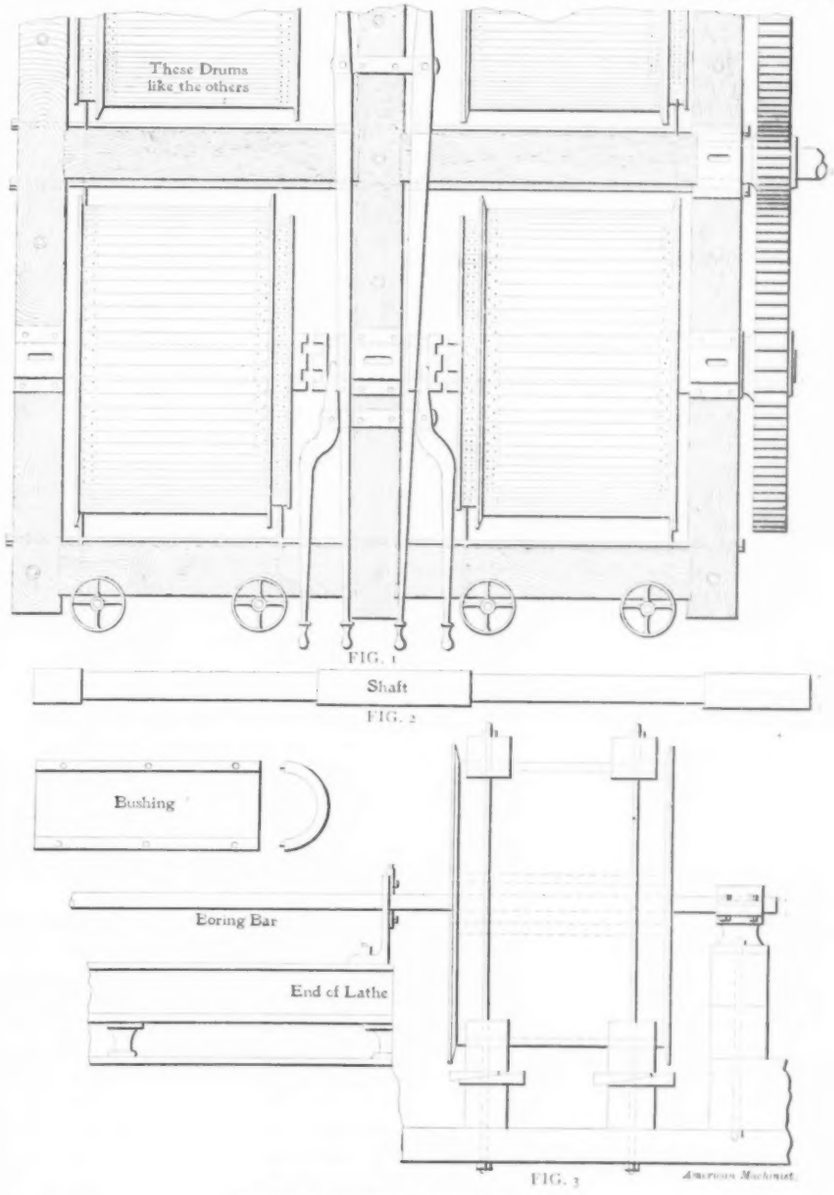
This plant gave us no end of trouble, and, running as it did day and night the year round excepting Sunday, there was little chance for keeping things in anything like good repair. The drums had two spiders with 3-inch plank lagging reaching from one to the other and bolted to the flanges of the spiders. A few braces were bolted diagonally across from one spider to the other to prevent them from twisting but which failed to keep them in place. Each drum was supplied with a strap brake. It required three men to operate the plant—fireman, engineer and brakeman. When a signal was given from the mine the brakeman would throw in the clutch of the drum and the engineer would start the engine, winding up the cable until a mark on it came to a fixed point, and then he stopped. The brakeman would hold the drum with the brake, throw out the clutch and let the empty car run back down the incline to its starting point. If the ore was being mined rapidly, two brakemen were necessary.

This constant work had worn the drum spider very much larger in the holes than the shafts, and had also worn the shafts. It was only a question of a short time until either an entire new set of drums and shafts must be procured or extensive repairs made. It was therefore "up to us" and our little shop and makeshift foundry to get out of the trouble as best we could. There was no possible way that we could see to use the old drum spiders. We could turn the shafts in our largest lathe, and decided to true them up where worn and increase the length of the bearing of the spiders on the shafts. Fig. 2 shows the shafts after they were trued.

The molding and casting of the four drums in our pig bed foundry was quite a difficult job. As we had no facilities for turning them, we were anxious to have them round and smooth. We swept up the mold in a pit, or, rather, we made it in the ground with the top of the cope about 12 inches below the bottom of the pig bed runner, using loam, and drying the mold with a charcoal fire. We lost one casting. The others were about as good as the general run of castings turned out of the foundries of the present day.

To bore these drums we made a boring bar and coupled it to the face-plate of our largest lathe, extending it over the end of the lathe bed and through the drum, all of which is shown by Fig. 3. We did a good job of boring, and did it quickly after we once had the tools and rig ready.

To complete the drums it was necessary to have eight brass bushings, 30 inches long, 9 3-16 inches outside and 7 11-16 inches bore. It was a short job to brick up a furnace and run a pipe from the blast furnace air receiver to it, and with char-



REPAIRING A MINE HOISTING PLANT.

coal for fuel we could melt brass in good shape. These bushings we bored to fit the small part of the drum shafts and turned them on the outside a running fit in the bored holes in the drums. We made two bushings for each drum in preference to one long one. After these were bored and turned we split them, drilled oil holes and cut channels on the outside surface and in the bore. We also drilled three holes in each edge of one half

and put in iron pins, leaving them projecting the amount of the stock cut away, thus making the bushings a running fit in the bore of the drum. In the hub of the drum at each end we put a large oil cup and from the outside of the drum, midway between the flanges, a piece of 1½-inch pipe ran into the hub. This was for heavy grease and was plugged below the surface of the wood lagging.

On a Saturday evening we began to remove the old drums, taking out two of them and sending the shaft to the shop to be turned. By Sunday noon we had the shaft back at the mine. We blocked it up, clamped the bushing in place and slipped the drum over it, following it with the second drum. The change was made and the two new drums in working order by 6 P. M. Sunday. The following week the other two were put in. We had no repairs to do on that part of the plant as long as I remained in the employ of that company, which was several years.

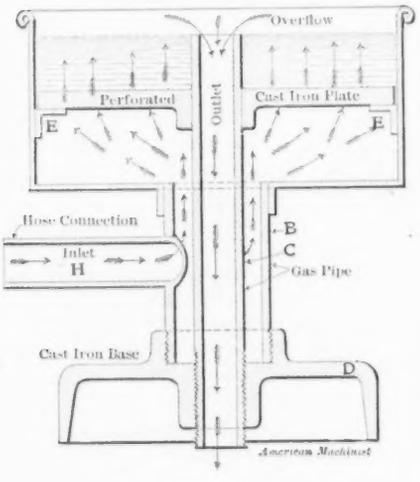
B. W. T.

A Tempering Tank.

Editor American Machinist:

I send sketch of a tempering or cooling tank which is very handy for small work when a number of pieces are to be hardened to a given depth. The water tank *A* is made of galvanized iron and fitted to *B*, which is threaded on the end and screwed to a base *D*. An outlet or overflow tube *C* also is threaded on the end and screwed into base *D*. Small angle pieces *E*, of galvanized iron, are secured to tank *A*, and on them is loosely placed a perforated cast-iron plate. To inlet pipe *H* one end of a hose is attached, the other end connecting with a hydrant.

The overflow pipe is screwed up or down to the required depth of hardening. The



A TEMPERING TANK.

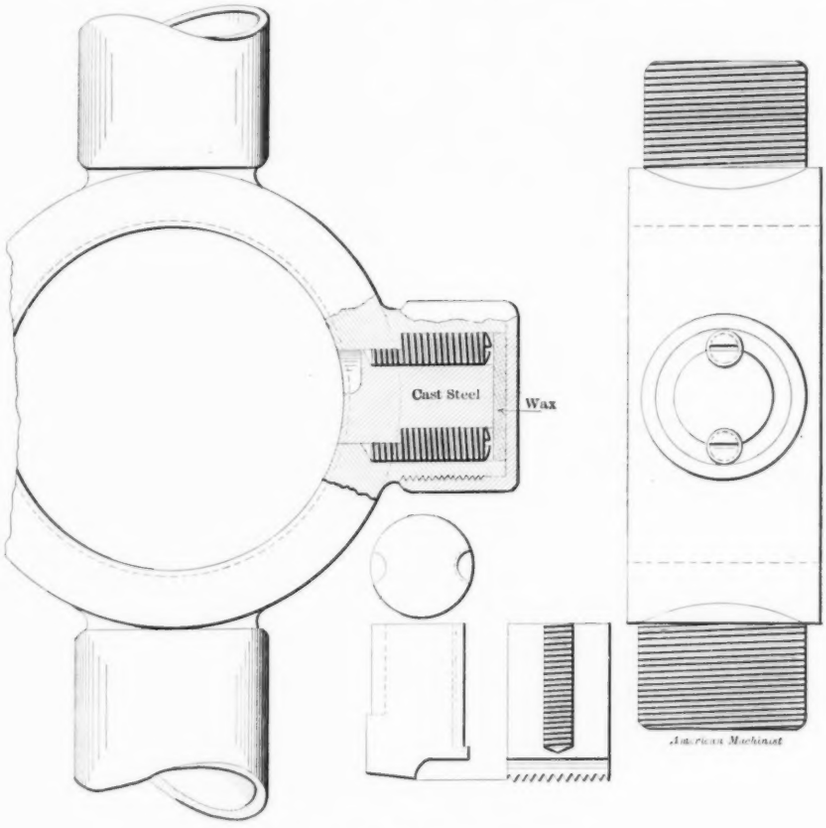
cold water flows through inlet pipe *H* up between *B* and *C*, through the perforated cast-iron plate and out through the overflow pipe into a sink, barrel or waste-pipe. By regulating the flow the temperature of the water can be maintained as desired. The article to be hardened is placed on the perforated plate over which is the required depth of water.

D. E. M.

Adjusting Chasers for Sizing Plugs.

Editor American Machinist:

It may interest some readers to hear how we solved a problem in screw gages in the Pushfinger shops. The proposition was to supply cast-iron plugs to fit threaded holes in cast iron, to duplicate the same and maintain the size year after year. These plugs were about 3¾ inches diameter, threaded part 1½ inches long (not tapered) to fit nicely the entire length. The sketch shows an adjustable gage or sizer, consisting of a ring with four projections or bosses. Each boss was bored 1 inch and a cast-steel plug was fitted snugly. A ⅜-inch hole was drilled half in the plug and half in the shell, the bottom of this hole nearly flat. Directly opposite, or on the other side of the plug, we drilled and tapped a ⅜-inch hole somewhat deeper than the ⅜-inch plain hole. This done we simply turned the plug half way round. It will readily be seen that we then had two holes, one with thread on the plug and the other threaded on the shell, so when we turned the screws against the half bottom one would push and the other would pull. We then bored and threaded the inside of the ring and the ends of the plugs; removed the plugs, which we will now call "chasers," put the clearance on and hardened them. We had a hardened steel gage to set the chasers, and when correctly set we filled the recess back of the chasers with wax, to prevent anyone tampering with the adjusting screws. The bosses were threaded on the outside; on two of them we screwed short caps and on the others tubing long enough for handles. I would like to hear from anyone who has used this two-screw device to hold and adjust chasers.



NOVEL DEVICE FOR ADJUSTING CHASERS.

ISAAC MORGAN.

Core-Box Hooks and Clamps.

Editor American Machinist:

It often happens that castings do not come from the foundry all O. K. The cored holes frequently are not as they should be, and when we hunt it up we find that the hooks on the core box are loose, one hook perhaps missing and the core box split from too frequent use of dogs. The coremaker has the riot act read to him. His answer, no doubt a very true one, "No time to get core box in shape—rush order." The result is that the core box is sent to the pattern shop for repairs or for a new one. For some time past we have stopped using hooks, dogs or clamps, and instead we use a square frame of ½ or ⅝-inch round iron welded and made up in different sizes and so that they will just slip over the end of the core box; a wedge tightens it, and it is there for keeps. Instead of having from two to four hooks on each core box you simply have a frame for about every twenty core boxes.

These frames work just as well with heavy core boxes, and will hold a long core much better than a clamp. In rolling them over they hold the frame and board much better and securer than any clamp that can be made.

For the larger size frames it is better to use 5/8-inch round iron. If the core box is in use often, fasten the wedges to the core box with a few screws. Then, all you have to do is to drive your iron frame either on or off, as required. If the core box is long, use two or three frames, while on small and short boxes one frame is plenty. Hooks, clamps and dogs seem a small matter, but look up the cost of your core-box repairs. C. NEIL.

Practicalizing an Invention.

Editor American Machinist:

Have you ever had to deal with the inventor who brings in his machine piecemeal and lets you know what he wants a very little bit at a time, suspicious that you may learn too much, fearful that in some way you may appropriate the ideas over which he has labored long and hard? Well, he called on me something more than a year ago, just as I was about at the end of the day's work and thinking of home. He had a rich Irish brogue, but was a regular Yankee to ask questions. He seemed an odd character, and interesting; so the hour of overtime I spent with him slipped away quickly. I soon saw that he was well informed in many directions and evidently had used his sixty or more years to some purpose. After he left I found myself thinking of him as "a fine old Irish gentleman." And I would say that in my after dealings with him I found him cheery, kindly and scrupulously honorable.

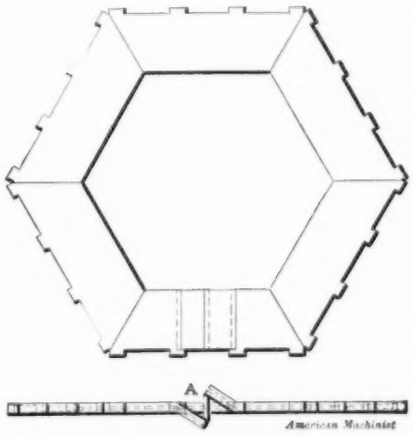


FIG. 1. A PARTITION PLATE.

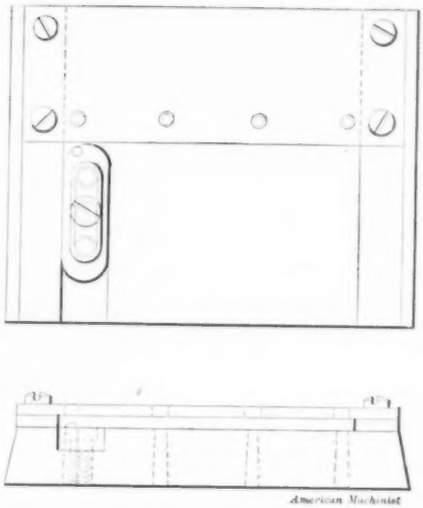


FIG. 3. DIE FOR PUNCHING THE SMALL HOLES IN THE SIDE PLATES.

On this first call he brought only a composition casting, a ring some 6 inches in diameter, and he pumped me well about making patterns, different kinds of castings, etc. The next time he came he brought one or two more pieces, and after several visits he brought in his model machine. I took it as evidence that I was getting into his confidence. Placing it on the drafting table, he remarked that he doubted if I could tell what it was for. As so far he had given me not the slightest clue, I had to admit, after looking it over, that the best I could do was to guess that it was some form of sorting device. He then told me that it was intended to sort mixed money, and was for the use principally of churches that had large collections of small coin to separate.

It was a crude affair, the work, evidently, of tinker and carpenter, but it did the trick very well. Substantially, it was a cylinder, some 6 inches in diameter by 12 inches long, with a thin helical partition, about an inch high, running the entire length. The space between the successive partitions was about 5/8 inch, and the shell was perforated with various sized holes. This cylinder was supported upon a small shaft, which in turn rested on bearings over a wooden box containing several drawers. One end of the shaft was bent to form a crank, and at this end of the cylinder was a hopper. The mixed coins being poured into this hopper fell into the open end of the cylinder, and as the crank was turned they rolled along the grooves, gradually moving toward the farther end. First they encountered the smallest holes, which were of a size to allow a dime to pass through, but would not admit a cent. Then came holes that would admit a cent, and lastly holes that would allow a nickel to pass through. Larger coins, silver quarters and halves, passed out at the end into the fourth drawer.

To put this device into such shape that it could be made in numbers at reasonable cost and do the work was what was wanted. At the outset it was apparent that the demand would be limited, so it would hardly justify a large outlay for special tools. Besides, my man wanted to make them without any special tools, and I had to do a lot of arguing before I could convince him that it was possible to save money by spending it for tools and fixtures. He finally saw the wisdom of it, or at any rate he gave in, and I received orders to go ahead.

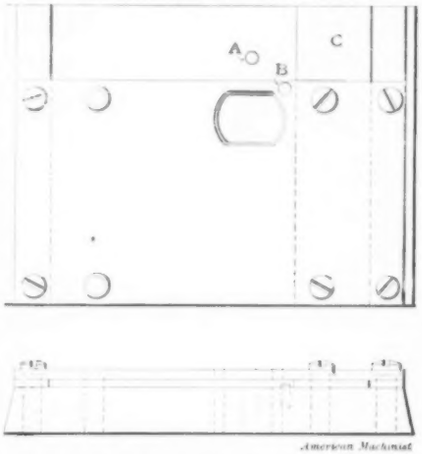


FIG. 4. DIE FOR PUNCHING COIN HOLES.

Concluding that a hexagonal prism would answer the same purpose as the cylinder, I had several patterns made as shown in Fig. 1. These formed a series of partitions in the hexagonal box, the outside of which was formed of flat plates with the coin holes in. It will be seen that I abandoned the helix principle, and instead I had an offset in each of these flanges or partitions within the space of an inch and arranged them all to come in line on one of the six sides. The part marked *A*, in Fig. 1, was for the purpose of keeping the casting in shape until the hollow milling was done, when it was removed with a straddle mill.

Fig. 2 is a view of that side of the hexagon on which the joinings of the castings were made, looking from the interior. This side differed from the other five in that there were but two rows of holes. The third row of the other sides is shown by dotted lines. These sides were made from

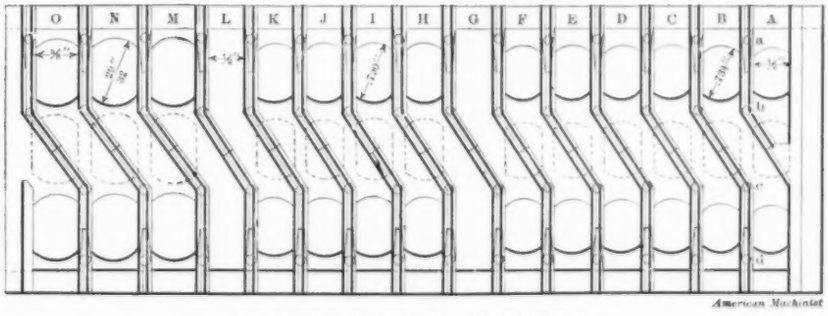


FIG. 2. ONE SIDE, FROM THE INTERIOR.

No. 18 Brown & Sharpe gage, half-hard sheet brass. The sections shown in Fig. 1 were ordinary yellow brass castings. The method of securing the sides to the castings was to punch rows of four ⅛-inch holes in each of the six sides, as shown at *a b c d*, Fig. 2, and then hollow mill the

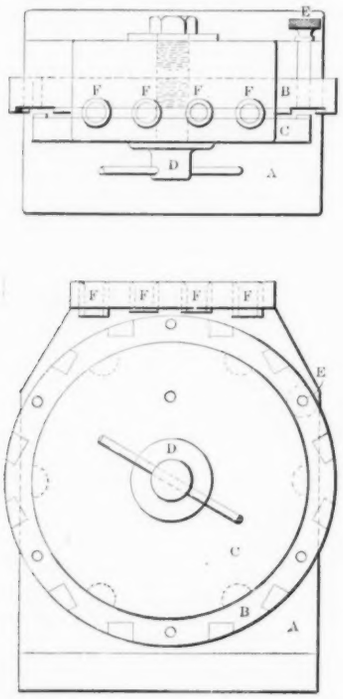


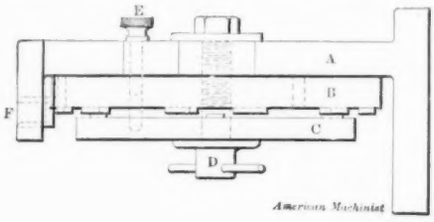
FIG. 5. JIG FOR HOLLOW MILLING THE PARTITION CASTINGS.

twenty-four projections on the castings to fit. When the sides were in place the tits thus formed were riveted down.

Fig. 3 shows the die used to punch the ⅛-inch holes in the sides. The stock having been cut to the proper length, the movable stop was set so as to punch the first row of holes at the proper distance from the end, and all of the side pieces were run through the press. Then the stop was set so as to punch 21-32 inch between centers, and the holes were punched up to and including those between spaces *L* and *M*. One more setting of the stop for the holes from *L* to the end finished the small holes.

The next operation was punching the large holes through which the coins were to fall into their proper receptacles. Three different dies were required, and as they were made to punch only a single hole at a time, considerable shifting was necessary. Still, as all of the indexing, with the exception of the end holes, was done from the ⅛-inch holes already pierced, the work went through quite rapidly. The manner in which these dies were made is shown in Fig. 4. *A* is a hole in which a pin placed forms the stop for the end holes. *B* is the stop used to locate all the other holes. The die is shown arranged to punch the two outside rows of holes, the stock being turned over for the second row. The movable guide *C* was then shifted to the other side of the die and the center row was punched. Using the second and third dies in the same manner completed the punching of the sides.

Fig. 5 shows the jig used for hollow milling the pin projections on the castings. Part *A* was planed up true and a



hole was bored to receive the hub of *B*, and the four bushings *F* were made and properly located. Plate *B* was then chucked, the back was faced, the hub turned a running fit in the hole bored in *A*, drilled and tapped, and then removed to the miller. The lugs on the front were milled and the six index holes were located and drilled. Plate *C* was bored, and the projections were faced off. The hub of *B* was then placed in the hole bored in *A* to receive it, and fastened with the cap-screw and washer as shown. After a little scraping it turned freely, and, being secured in the proper position, the hole for the index pin *E* was transferred to the part *A*.

In operation, one of the brass castings was placed on plate *B*, covered by plate *C*, and bolt *D* was screwed down. The four pins on one side of the casting were then hollow milled, the index pin was loosened, the plates were turned to the next index hole, and the operation was repeated until the six sides of the casting were completed. The die shown in Fig. 3 was used to transfer the holes for the bushings in the jig, and being very carefully done, very little trouble was experienced in assembling.

And now the next time you drop a coin

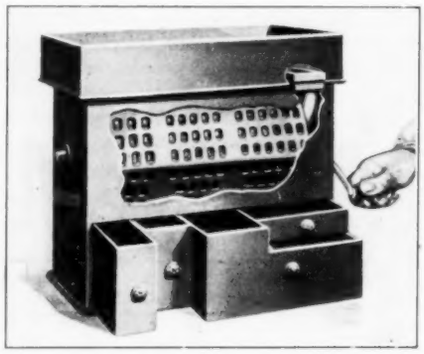


FIG. 6. A PRACTICAL COIN ASSORTER.

in the contribution plate, please remember that perhaps it will eventually pass through one of these sorters.

J. A. WEBSTER.

[The half-tone, Fig. 6, shows one of the machines as now made. The first drawer at the right is for dimes, the next and much larger one is for cents, the third for nickels and the fourth for quarters, half dollars dropping out at the end. One of these machines has sorted $165 in five minutes. We are informed that thirty-four of them are used in churches in New York city alone, so that the invention was one well worth "practicalizing."—Ed.]

An Old Lathe as a Special Machine—A Spherical Boring Tool.

Editor American Machinist:

I had charge, several years ago, of a machine shop where all the work was handled in the old-fashioned way. The employer was complaining all the time that it was impossible to meet competition, that the parties offering to the public cheaper machines were selling an inferior grade of machines, and that he thought it necessary to cut the wages of his men and reduce all the other expenses. I tried to make him understand that his competitiors were using improved machinery, improved methods and had better paid men; I told him that I would put new life in his shop, reduce the cost of production, increase the output and put the shop on a good paying basis if he would allow me to do it. I explained, and finally made him understand, that if a shop is not equipped with modern machinery an ordinary lathe or planer may be changed into a special machine that will produce as much work as a first-class modern tool.

Starting on an old lathe with a broken cross feed (a machine that none of the boys would use, owing to its being altogether out of order), I had its boxes repaired, its cross carriage removed, and in its place a boring bar holder fitted as shown in Fig. 1. This holder, which was held in place by four screws, was bored very carefully in position, was split and had two strong screws to hold the bar tight. The spindle of the lathe was bored larger than the bar, and a good chuck put in place and bored to receive a bushing *A*. This bushing was bored to fit the bar and acted as the guide.

I had a number of special tools and holders made, a few of them being shown in Fig. 2. The boring tools shown at *D* were of several sizes, to cover the range of work usually done in the shop, and there were two sets of them made for roughing and finishing.

The tool-holder—shown at *A*—was a light and strong steel casting that held firmly in position tools of the type shown at *B* and *C*. Several of these holders were made; one of them was used to hold two grooved roughing facing tools, made of self-hardening steel, as shown at *B*. These tools covered the whole side to be faced, and while this roughing operation was being performed the machine was run at slow speed, until the scale of the casting was removed. Another tool-holder was used for two finishing facing tools that also covered the whole surface to be faced.

These holders were held in place at *B*, Fig. 1, by means of a key and set-screw. Tools of type *C* were used in other holders for outside roughing.

A bar *E* was bored to receive twist drills and taper reamers. The reamers were roughing and finishing, and were all guided by bushing *A*, Fig. 1. Pieces of the type shown at Fig. 3 were machined in a remarkably short time—never dreamed of before in that shop—and a boy could run the machine after the tools were set properly in the holders.

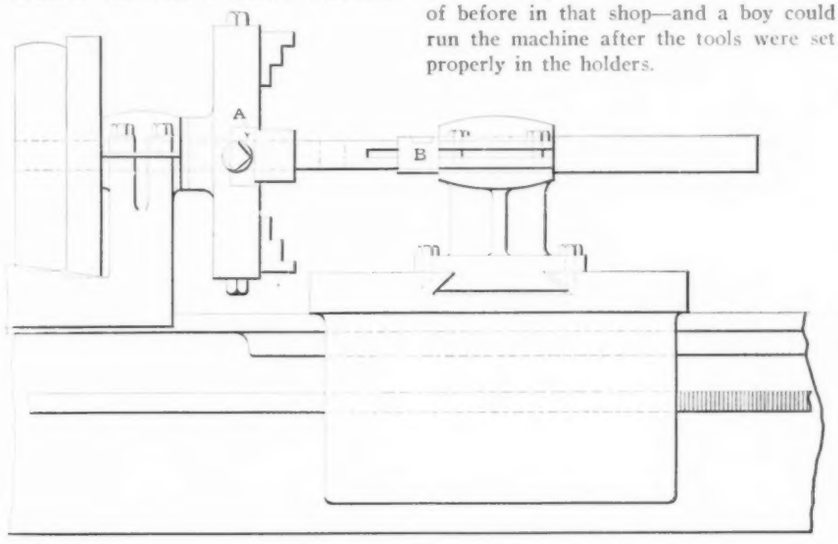


FIG. 1

AN OLD LATHE AS A SPECIAL MACHINE

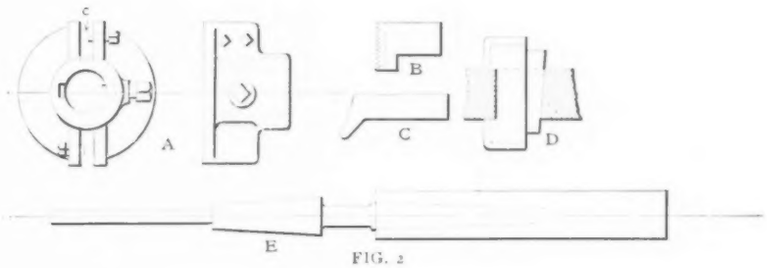


FIG. 2

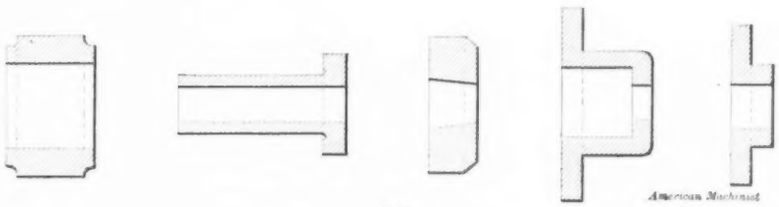


FIG. 3

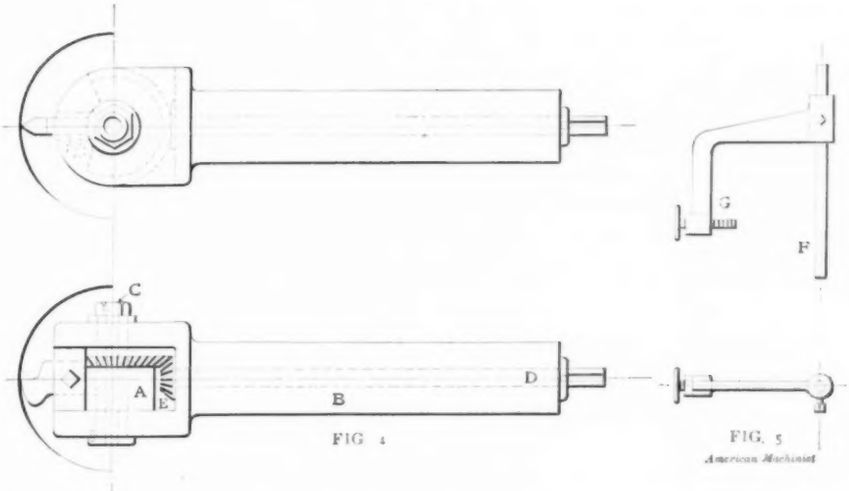


FIG. 4 FIG. 5

SPHERICAL BORING TOOL.

Fig. 4 shows a tool that fitted the bar-holder and was used for turning out a large number of spherical bearings. Bar *B* is enlarged at the end and slotted to receive a piece *A* that turns on pin *C*. Fitted to A is a tool-holder and a segment of bevel gear that meshes with bevel gear *E*, the hub of gear *E* fitting a hole drilled in the center of the bar. A handle at the end of the stem is used to turn piece *A* about pin *C*. The hole for the pin must be exactly in the center of the bar and perpendicular to its axis. Fig. 5 shows the gage used for setting tool *H* at given radius—the rod *F* in the gage fitting a hole drilled in center of pin *C* (Fig. 4). Screw *G* is set at the proper distance from rod *F*, and when F is slipped in the central hole of pin *C*, the tool *H* is set out to just touch the screw. This tool worked satisfactorily also in turning fillets in large pieces.

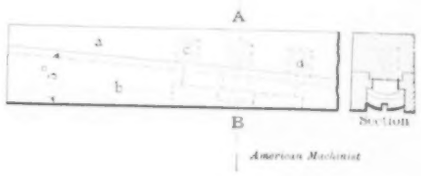
J. MENEGUS.

Adjustable Parallel.

Editor American Machinist:

I enclose a sketch of an adjustable parallel, consisting of two wedges *a* and *b* milled at an angle of 5 degrees, as shown. The upper part *a* has a tongue fitting snugly in a groove in *b*. This lower half *b* has a slot milled through about 1½ inches long by 5-16 inch wide. The slot is milled to ½ inch in width at the bottom to admit the screw head. Upper wedge *a* has three tapped holes for a 5-16 inch screw.

In practice the screw can be placed in



ADJUSTABLE PARALLEL.

any of the three holes and the upper half slid up or down until the desired hight is obtained, when the screw can be tightened and the parallel thus clamped to a fixed size.

This parallel is especially adapted to milling machines or shapers, and is very handy in machining thin strips, as it can be set in relation to the vise-jaws so that the maximum hold can be had on the work.

As it is shown in the drawing, it can be made of cast iron with the tongue solid; if, however, it is desired to make it of steel so as to harden and grind it, the best plan would be to have a groove in both halves and put a short tongue in each end.

C. B.

The Supreme Court of Iowa has decided that a bicycle used by a painter, paper-hanger, etc., in connection with his work is exempt from execution because part of the tools or equipment by which the owner is enabled to make his living.

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In ordering a change of address, if our subscribers would remember to send *former* as well as present address, they would avoid delay and possible loss of one or more issues of their paper. It is necessary we should have the former address, because the mailing list is arranged geographically, and your name cannot be found on it unless we have the full address as given on the list.

Practicalizing.

On another page of this issue a correspondent tells an interesting story of the "practicalizing" of a certain invention. The word, although not in common use, is one in good standing in the English language. The Century dictionary gives a quotation from J. Stuart Mill in which it occurs. It is a word not often found in the individual vocabulary of the general mechanic, although it would be a very handy word for him if he had it where he could easily lay his tongue to it, and, although we certainly do not favor long words, this one in its place is, we think, to be commended. The operation represented is one often talked of in terms less concise and convenient. There are men in jobbing shops, model-making shops and the like, also in the tool shops and elsewhere in the large establishments, who spend most of their time in "licking things into shape," in getting them so that they can be made and sold at a profit, in eliminating an objectionable feature from some otherwise very satisfactory device, and other such services as that, who are simply practicalizers. There are many things in actual use which would be much more efficient and valuable if they had still further felt the touch of the practicalizer. We are not sure that the practicalizer is not, after all, the most necessary of all the functionaries of progress and development, for many successes are directly traceable to him and many failures result from a lack of his services. A man of proper qualifications who should set himself up and announce himself as a professional mechanical practicalizer ought to find a plenty of remunerative employment, and those he worked for should profit largely by employing him. No professional practicalizer, however, nor any number of them could do all the work demanded in their line, for the line would extend to all departments of activity and production. Not only should there be a practicalizer in every establishment, but every man in it should be more or less, and as completely as possible, a practicalizer. The usual purpose of all business activity is to make things pay, and this is of course most completely accomplished by the most complete co-operation, and this is the highest type of practicalizing. To be a practicalizer of practicalizers might well be the highest aim of the head of any industrial establishment.

Alleged Corruption in British Workshops—the Maintenance of Industrial Efficiency.

There is an article in the August number of *The Engineering Magazine* which is likely to attract considerable attention from those who, in England and elsewhere, take an interest in the industrial and commercial problems that confront Great Britain. This article is written by T. Good, who is described as a man who has made his own way in the world, worked at various occupations (in Britain always) since thirteen years of age, has taken a part of some prominence in trade union affairs there, and is now in business for himself as a manufacturer.

He declares in effect that the manufacturing establishments of Great Britain are honeycombed with dishonesty—*i. e.*, that a very large proportion of the men who have continuous employment in good situations retain it by bribery in one form or another. The management of large establishments, he declares, is in the hands of managers or foremen who seldom have any pecuniary interest in the establishment, and appointments to responsible positions are made for reasons other than the securing of the best possible man for the place. Managers and foremen, Mr. Good declares, regularly receive payments in some form or other directly or indirectly from the men under them holding the most desirable positions. One way is for a foreman or manager to designate certain tradesmen with whom the employee is to trade. "Under such a manager, all the lazy, inefficient man has to do in order to keep his employment, whether trade be good or bad, and to get paid for a liberal amount of overtime [whether he works it or not], is to patronize the shop-keeper whom his manager nominates. There are many managers and foremen in Britain who draw more money from shop-keepers in the shape of commissions than they draw in salaries or wages from their employers."

By money lending also at high rates of interest managers acquire an interest in certain men working under them which prevents impartial treatment in the sole interest of the establishment and directly discourages and drives out the best men; who will not stoop to methods of holding their positions which are essentially dishonest and debasing. "Whenever," Mr. Good says, "I find a man employed uninterruptedly for a great number of years in a large shop where other men are being constantly suspended or dismissed, I am suspicious of that man's ability and integrity."

Of course it is quite certain that if this condition of affairs really exists to anything like the extent charged, it will have to be rooted out before Britain's industrial establishments can hope to successfully maintain their prestige. It is the very condition that so often obtains under corrupt governmental management and which, when it does obtain, absolutely pre-

vents work being done at a reasonable cost.

The editor of *The Engineering Magazine* states that he secured considerable confirmation of Mr. Good's statements before publishing the article, nevertheless we are unable to believe that the reality is so bad as to justify being painted in such very dark colors. There are men here in America who would paint almost, if not quite, as dark a picture of the condition of things here. Such have been offered us for publication more than once. There are those who are so constituted that they can have no faith in their fellowman. To them everyone who succeeds does so because of some "pull" or by the working of some influence other than his ability. Such people believe that everyone is "down on" them and that they "have no show." If they see a shopmate talking on pleasant terms with the foreman, or the superintendent, or the proprietor, they put him down as a "sucker," and their only idea of a manly and independent workman is one who always has his elbows stuck out when a "boss" is around and lets the bosses see that he "don't care a dam for them." It would not do to take the views of such men regarding the conditions of employment in our industrial establishments.

However, we know that good situations that afford enough to enable comfortable living are not as plentiful nor as easily found in Great Britain as they are here. In other words, there are more men seeking employment in proportion to the number of good positions. There are short-sighted individuals who seem to think that such a condition is conducive to industrial development because it makes "cheap and abundant labor." No greater mistake could be made.

On this point a book recently published throws considerable light. The book is called "Poverty—A Study of Town Life." It is published by the Macmillan Company and was written by B. Seebohm Rowntree. The author made a very systematic and thorough study of the conditions of living in the city of York, England. He first determined with great care what was absolutely necessary to maintain life and physical efficiency in that town and what it cost. Then he made a very careful and thorough canvass to determine how many workmen in the town were able to supply themselves with these elementary necessities of life, and how many were not. So carefully has the author gone about his work that his report, his method of gathering his facts and his marshalling of them have all the beauty of a mathematical demonstration, notwithstanding their dismal outcome.

He found that in York 7,230 persons, or very nearly 10 per cent. of the total population, could not with their earnings supply themselves with the things absolutely necessary to maintain merely physical efficiency. In other words, one person in ten in York (and presumably in other towns of the United Kingdom as well) is suffering more or less from starvation, and the conclusion is drawn from other facts fully set forth that about 43 per cent. of the working classes are living, to say the least, in indigence. The author says:

"Let us clearly understand what 'merely physical efficiency' means. A family living upon the scale allowed for in this estimate must never spend a penny on railway fare or omnibus. They must never go into the country unless they walk. They must never purchase a half-penny newspaper or spend a penny to buy a ticket for a popular concert. They must write no letters to absent children, for they cannot afford to pay the postage. They must never contribute anything to their church or chapel, or give any help to a neighbor which costs them money. They cannot save, nor can they join sick club or trade union, because they cannot pay the necessary subscriptions. The children must have no pocket money for dolls, marbles, or sweets. The father must smoke no tobacco, and must drink no beer. The mother must never buy any pretty clothes for herself or for her children. . . . Should a child fall ill, it must be attended by the parish doctor; should it die, it must be buried by the parish. Finally, the wage-earner must never be absent from his work a single day. If any of these conditions are broken, the extra expenditure involved is met, *and can only be met*, by limiting the diet; or, in other words, by sacrificing physical efficiency."

Of course, such conditions cannot be complied with, which accounts for the difference in numbers between those who receive less than enough to maintain "physical efficiency" and those who, though receiving this much, or a little more, yet live in extremest poverty.

It is not a pleasant subject and we introduce it only because in considering questions of "industrial supremacy," etc., social conditions affecting mental, moral and physical conditions of working people must be taken into account. To a surprising degree men of all races act the same under like circumstances, and, wherever or whenever the penalty for loss of a position may be or probably will be starvation for a workman and his family—wherever and whenever workmen see that the power of deciding whether or not they and their families shall starve rests with one man who has the power to give or to withhold a job—there and then will be found tyranny, moral turpitude, bribery in some form, general inefficiency of labor and discouragement of honest effort.

America has been known, and still is known, as the "land of opportunity." It has been so, not because it has been inhabited by a superior order of beings, but because the process of building up has been going on and capital and labor have been able to co-operate in the development of natural resources that have been, and still are, easy of access compared with those of Europe. This has enabled every man to "have a chance" and has given workers generally the ambition without which men are of little value, as industrial workers.

In any study of industrial conditions in America and Europe, this phase of the subject must be taken into account and he who thinks that simply by the importation of improved machinery and shop methods a starving or oppressed people, a people with closely circumscribed opportunities for the attainment of legitimate and proper ambitions, can compete successfully with people more fortunately situated in these respects, does not look into the problem deeply enough to perceive its most powerful and influential factor.

Machine Work Done in the Foundry.

In our present issue, among the "Letters from Practical Men," will be found one entitled "Micrometrical Precision in Iron Casting." The letter is quite unpretentious in appearance, except perhaps for its title, which did not originate with the writer of it. We depart a little from our usual practice to commend it to the special consideration of the classes of our readers to whom it should be of interest. To molders it first appeals as indicating a distinct and profitable advance in a detail of foundry practice not yet familiar to the entire trade and probably known to only a very few. The foundry is not the place where we have been in the habit of looking for the minute precision which the title that we have given to the paper would seem to indicate, but the story which the writer tells we believe to be entirely without exaggeration, as we have seen some of the castings of which he speaks. The results accomplished being as described they of course speak of opportunities of economy to the machinist and the shop proprietor. They suggest changes in machine-shop practice and a different planning and doing of certain lines of work. In agricultural machinery, in textile machinery and various other lines, the amount of drilling and boring involved is a considerable item of the entire work, and the saving of most of this, as suggested by our foundry friend, is really a gift of great value to the machine trade. Of course the process as described carries with it suggestions both as to the limitations of it and as to its possible extension. On account of the shrinkage, holes of large size cannot be cast with the steel core, an inch being here mentioned as a limit, but this suggests the extension of the process to the production of external surfaces with the same precision and finish as is possible with the holes, so that the field of experiment suggested by the letter is a wide one. The letter is also another notable example of the readiness of the American mechanic to tell of his improved methods, or, as some might put it, to give

away his competitive advantages. Doubtless he will continue to do this thing, and it is our pleasure to help him in it as we have the opportunity, believing that just here is the practice which, more than any other, tends to raise the standard of American machine-shop practice and keep it ahead of such practice elsewhere.

Drilling Extraordinary—Erratum.

Our attention has been called to an error in the article under the above title, printed at page 1044. The feed for the 4-inch drill was given as .012 inch per turn. The figure should have been .072 inch.

Rear Admiral George W. Melville, Chief of the Bureau of Steam Engineering, will be sixty-two years of age in January next, and under the law he must be retired from active service. Such a retirement would be very regrettable and very detrimental to the best interests of the navy and of the nation. The government has in no department a more faithful and efficient and in every way valuable servant, and the special powers adapting him to the office he holds were never in fuller efficiency than to-day. It is a welcome announcement that a way has been found by which it will be possible to retain his valuable services for an indefinite period. About three years ago Congress passed a law enabling the President to assign retired officers to duty. The President and the Secretary of the Navy can exemplify the wisdom of this law by letting it be known that no successor will be appointed to Admiral Melville, and this it is understood will be the course pursued. During the seventeen years that Admiral Melville has been at the head of the Bureau he has commended himself to the approval, not only of engineers, but of all thinking men by his outspoken manliness of utterance upon the live and important questions connected with his department. He has been a living and powerful force for the education of the navy. He can be relied upon to promote and advance both the engine and the engineer, and his mental powers seem to be in no way lessened with advancing age, but on the contrary he seems as vigorous as ever. It is hoped he will be long spared for the service which he has done so much to improve.

Correct Postal Information.

Editor American Machinist:

In your reply to "W. R. S.," at page 946, you say that drawings with dimensions, etc., are *first-class* matter, on which the rate of postage is *one cent*. This is an error, as *all* first-class matter is two cents per ounce. You also say that blueprints are third class, which is correct, but that the rate is two cents for two ounces. This too is an error, as third-class articles are subject to a rate of one cent for each two ounces. Simple drawings are fourth class and the rate is a cent for each ounce. You probably have this information, but have simply made a mistake in making the assertion. You will pardon me for calling your attention to it. I thought best, as someone not used to this portion of the Postal Law might blunder and cause himself or others considerable extra expense.

LIDA M. BROOMALL.

It is announced that Lieutenant Davis, of the Ordnance Bureau, has devised a new method of hardening armor plate, by which carbon is put into the plate to any required depth by the combined action of heat and electricity. The results are declared to be very superior, and if this is true, the discovery may be of importance in the manufacturing of things other than armor plate.

It is reported that the Krupp establishment will decline to exhibit at the St. Louis Exposition, the reason given being that the large gun which they exhibited at Chicago and which it seems they expected to sell here was not purchased and is still on their hands. In addition, they are said to object to the fact that no decorations of any kind are obtainable in an American exhibition. The impulse which one might feel to smile a little at this latter reason may be checked by a contemplation of the eagerness with which decorations were sought by some Americans at Paris.

A company headed by J. Dana Bickford, who is described as "a well-known inventor of Vermont and New Hampshire," will organize a "home" for inventors who are not provided with any other home and who may need help. Prominent and successful inventors and "captains of industry" will be asked to contribute funds, and a property known as the "Old Mansion House" in West Medford, Mass., has been secured for the purpose. A working laboratory will be fitted up in which the old inventors may still work upon their inventions if they wish to do so.

Personal.

A friend wishes the address of Emory P. Angevine, who worked for the Columbia Typewriter Company, Centre street, New York, about 1895.

Our contributor, Wm. H. Booth, has now fixed his permanent address at No. 2 Queen Anne's Gate, Westminster, London, S. W., where he is dealing with questions of steam engineering, testing, electric light, traction and power distribution, etc.

It has recently been made public that Wm. B. Cogswell, vice-president and general manager of the Solvay Process Company at Syracuse, a prominent member of the American Society of Civil Engineers and of the American Society of Mechanical Engineers, was married, April 30, in New York city to Miss Cora Browning.

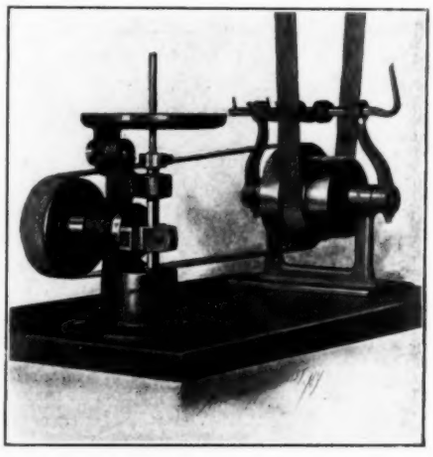
Some New Things.

CIRCUIT BREAKER FOR USE IN CHARGING STORAGE BATTERIES.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, have brought out a new circuit breaker which is intended for use in charging the storage batteries of automobiles, its office being to automatically protect the battery from overcharging. To this end it is made to open the circuit whenever the charging voltage across the battery terminals rises to the point desired. The instrument may be used to give a full charge when time permits or, when time is limited, it may be used to insure as full a charge as is possible in the available time, and in all cases it protects the batteries from the natural effects of carelessness or ignorance.

BENCH FILING MACHINE.

This machine is designed for filing dies, templets and other close work. It is simple in construction and requires little description, the manner in which it is driven being clearly shown in the half-tone. The



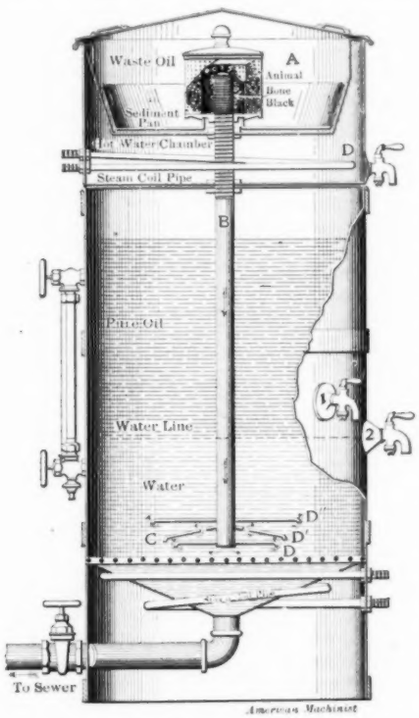
BENCH FILING MACHINE.

vertical shaft, or ram, is drilled out at the upper end to receive the file holder which is clamped in place by the screw in the collar at the top. The holder, which is a short brass rod to which the files are soldered, is let into the shaft so that the end of the file is used first. When this part of the file becomes dull it is broken off and the holder is adjusted in the shaft to bring another section against the work. In this way the entire file can be used. A portion of the shaft is milled away at the top so that, if desired, a file can be clamped in place without the brass shank. The table on which the work is placed can be tilted to any angle desired. This machine is made by the Henry & Wright Manufacturing Company, Hartford, Conn.

THE AMERICAN OIL FILTER.

The accompanying illustration shows a new oil filter which has been brought out by the Burt Manufacturing Company, of Akron, Ohio. While it resembles somewhat the Cross filter made by the same

company and illustrated in our columns some time ago, it will be noticed that the general arrangement here is altogether different from that in the older filter. The lower water chamber in this new filter has a conical bottom, the steam coil for warming the water being placed at the outside, as shown. On top of this chamber, or tank, is another water chamber



THE AMERICAN OIL FILTER.

also provided with a steam coil. In this upper chamber is placed the pan which holds the oil to be filtered. The arrangement of the filter cylinder in this pan and the feed pipe down which the oil passes to the plates at the lower end is clearly shown. Before using the filter, water is poured in until it rises to cock No. 2 in the lower chamber. The upper chamber is then filled, and, steam connection being made, the water in both chambers is heated. The oil to be filtered is then poured into the pan *A*, where much of the foreign matter settles to the bottom of the sediment pan. The oil being warmed by the hot water surrounding the pan flows freely through the filtering material and down the pipe to the lower plate *D*. It then spreads out in a thin film on the face of this plate and, following the direction indicated by the arrows, passes up over the edge to the lower side of the plate above. Here it flows toward the center until it reaches the holes in the plate and then goes up through to the third plate. After spreading out over the bottom of this plate it is separated in five particles, and as it passes up through the warm water is thoroughly cleansed. The pure oil is drawn off through cock No. 1. The impurities removed from the oil in the lower chamber settle to the bottom and are drawn off through the waste pipe. By unscrewing the filtering cylinder at the top the sediment pan can be easily removed and cleaned. The filter is made in twelve sizes, the capacities ranging from 3 gallons to 500 gallons per day.

Commercial Review.

NEW YORK, Monday, August 4.

An interesting commentary on the condition of the market for American machinery abroad is afforded in the announcement of the Robert W. Blackwell & Co., Ltd., engineers and exporters, that they will close their office at No. 120 Liberty street at the end of this month. The concern is a foreign one, having offices in London, Paris, Milan, Cardiff, Liverpool, Brussels and Manchester. Its business has been in machinery of all kinds, particularly electrical equipment. It has maintained a New York office for over three years at the above address. This has been in charge of Seymour Folwell. In speaking of the relinquishment of their American branch with a representative of the AMERICAN MACHINIST, Mr. Folwell said:

"Three years ago when we opened our New York office it was on the belief that our business justified it. The business we did during the first two years left no doubt of that fact. It was both large and profitable. During the past year, however, our business has fallen off greatly. The conditions responsible for it being, in our opinion, likely to continue for some time to come, we have decided to close our office. Hereafter we shall be represented in America only by a shipping department.

"We have no hesitation in saying that the great industrial prosperity of America is responsible for the severance of our business relations with it, so far as maintaining a special office is concerned. At the present time your manufacturers, particularly in the machinery line, seem to have such a large amount of domestic orders on hand that they are either unwilling to take foreign ones, or, if they do take them, cannot fill them within a reasonable time.

"I am well aware of the fact that deliveries of machinery at present are unsatisfactory, even to American purchasers, and that, too, despite that all of the plants are working to their fullest capacity. But the grievances of American purchasers in this connection are mild by way of comparison with those expressed by purchasers in Continental Europe. On numerous occasions we have been unable to fill foreign orders for American machinery, because delivery could not be promised in the time demanded by our customers.

"Then again, the prices of American machinery are too high. This has been the opinion in Europe for some time, but all doubt of it was removed when the manufacturers of some of your chief machine tools met recently and decided upon a formal advance of 10 per cent.

"With the probable effect of these advanced prices from an American standpoint, I am not in a position to speak. With the effect they will have from a European standpoint, all my advices are that they will have a tendency to decrease the demand for American machinery abroad. At the present time the purchaser of machine tools abroad is having his orders filled in Europe, particularly in England and Germany. Not only can he buy them cheaper than here, but he can have them delivered quicker than here.

"Only a few days ago, for example, we were given an order for thirty-six miles of copper wire. After making extensive inquiries as to the lowest price we could purchase the wire here, we discovered that our Paris office could supply it much cheaper. Now, copper wire is about the last commodity in the world where foreigners can outsell Americans in, yet it is only one of a large number of cases of a similar kind that have come to our attention.

"Some of your manufacturers, however, are looking ahead, and are acting accordingly. They realize that the present industrial prosperity of your country cannot last forever, and in selling machinery abroad are disposed to make concessions, particularly in price. When the dull times come, as eventually they must, and when orders from any section of the world are welcome so long as they insure a reasonable profit, it is this class of men who will be favored."

Mr. Folwell's comments reflect the conditions of the American machinery market abroad so perfectly that it seems almost impossible to say anything by way of addition to them. In contending that American machinery houses are not seeking orders abroad, or if they do seek or take them, cannot promise delivery within a reasonable time, he not only states facts that are beyond contradiction, but gives reasons for his conclusions that will be concurred in by many.

With his views on the injurious effect recent advances on prices of American machine tools will have on trade abroad, there will perhaps be some dissent. It is a noteworthy fact that when these advances were made it was not a difficult thing to find in this vicinity some who questioned the wisdom of such a course. Much, if not all, of this adverse feeling has now disappeared. Subsequent events have shown that some of the fears expressed, speaking of domestic trade alone, have not come to pass. It is nearly two months ago since the prices of lathes were advanced, yet the manufacturers say they have not noticed any falling off in the demand for their machines. In fact, many machinery houses declare that their business during July was better than in June.

All reports are to the effect that our machinery trade with Europe, speaking

particularly of machine tools, is in a very unsatisfactory condition. Proof of this fact is not only furnished by the Blackwell Company's experience, but also from other sources. An American machinery firm made a contract three years ago with a gentleman to represent it in England. It called for a yearly salary well up in the four figures. Recently this house terminated this contract on a satisfactory cash basis, although it had two years to run. Its reasons for doing so were that results were not what it expected, and besides it had so many domestic orders on its books that it was not disposed to take orders from Europe. It is obvious that so long as much of such a sentiment prevails machine tool builders here are not likely to keep their prices stationary in the face of advancing prices for materials and labor and for fear it may affect foreign trade at some time when they may possibly need it. "A bird in the hand is worth two in the bush" is an old saying and one which expresses the view men are pretty sure to take under present conditions.

Builders of large steam engines report a scarcity of orders recently. One of them explains it by saying that about two years ago a number of large orders were given out, and the engines are now in operation. He says that in a short time it will be definitely known whether or not they are sufficient to meet requirements. He states that in several cases he knows where they will not, and believes that some substantial orders are among the possibilities of the near future.

That everything will eventually find its proper level is shown by recent developments in the oil fields. It is only a short time ago that the attention of investors was directed by glaring advertisement to the handsome profits that were to be made in the purchase of oil stocks of certain companies. Simultaneous with this, manufacturers of oil well machinery and supplies had their attention called to the same thing. No persuasion was brought to bear on them, however, to purchase stock, but they were asked to help the good work along by taking it in payment for their goods. So far as can be learned, none of them did so. Apparently they are glad they did not, for many of these companies have gone out of existence, or are making notable progress in that way. The development of the oil fields is now, for the most part, in good hands, and some very good orders have been received recently by those who furnish the necessary machinery and supplies.

The Northern Engineering Works, Detroit, Mich., report among other sales and installations of their three motor electric traveling cranes in the Cleveland district, through Chas. E. Stamp & Co., sales agents for Cleveland district, the following: To American Steel & Wire Company, one 25-ton 40-foot, one 50-ton, one 15-ton, 5 motor; Theodore Kundtz, one 10-ton, one 5-ton; Shelby Tube Company, two 3-ton; Republic Iron & Steel Company, one 15-ton Ingo crane, one 3-ton; Novelty Iron Works, Canton, one 10-ton; Aultman & Co., Canton, one 10-ton; Youngstown Steel Casting Company, one 20-ton and two 5-ton; besides a large number of smaller electric and hand-power cranes in the same district.

For the Susquehanna Iron & Steel Company's new plant at Columbia, Pa., the Pittsburgh Gage & Supply Company, Pittsburgh, Pa., will furnish three 250 horsepower water-tube boilers. The same company has also closed contracts with the National Steel Company to furnish complete White Star filtering system for a vertical cross-compound blowing engine; also filtering systems for the Electrical Department of the Carnegie Steel Company, Homestead Works, and the Wheeling Steel & Iron Company, Wheeling, W. Va.

Quotations.

NEW YORK, Monday, August 4.

The market for pig iron still continues to be marked by diligent inquiry for spot delivery, for which high prices are being paid. Foreign irons are utilized by those having demands to meet this year. The situation in 1903 iron indicates that sales have eased up a little, and there is a tendency to await future developments. New York prices for summer delivery are about as follows:

Northern:

No. 1 X	$23 50	@ $25 00
No. 2 X	22 75	@ 23 50
No. 2 plain	22 25	@ 22 50

Southern:

No. 1 Foundry	22 00	@ 23 00
No. 2 Foundry	21 75	@ 22 50
No. 3 Foundry	21 25	@ 22 75
No. 4 Foundry	20 25	@ 21 25

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93c. upward in carload lots. Smaller quantities from store, 2.15 @ 2.20c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 11⅞ @ 12⅛c.; electrolytic and casting, 11⅞ @ 12c.

Pig Tin—In 5- and 10-ton lots, f. o. b. New York, 28¼ @ 28⅜c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—5⅜ @ 5½c.

Antimony—Cookson's, 10 @ 10¼c.; Hallett's and U. S., 7¾ @ 8c.

Lard Oil—Prime City, 82 @ 83c., according to brand and quantity ranging from one barrel up to large lots.

New Corporations.

Perfection Blind & Lockstitch Sewing Machine Co.; capital, $1,000,000; object, manufacturing sewing machines. Incorporators: Charles Studden, Richard Barlow and Samuel B. Goshan, all of Trenton.

The Edgar S. Low Company, of Pittsburgh, Pa., has been incorporated in Delaware, with $100,000 capital, to manufacture locomotives and engines of all kinds. The incorporators are Edgar S. Low, of Adams, Low & Co., railway equipment brokers, of Pittsburgh; M. A. Low, of Pittsburgh, and William Simmons, of Chicago.

Manufacturers.

A factory building will be built at Allentown, Pa., by L. H. Yeager.

The Burlington Railroad is building a very large roundhouse at Creston, Ia.

The Riverview Worsted Mill at Waterville, Me., will be enlarged immediately.

The Park Hosiery Company will rebuild its burned plant in Pottstown, Pa.

Harding & Sons, shoe manufacturers, will build a factory in Lockport, N. Y.

The Syracuse (N. Y.) Malleable Iron Works will be considerably enlarged.

The Stanley Instrument Company will put up a new works at Great Barrington, Mass.

Hahn & Stumpf, patent leather manufacturers, will erect a factory in Newark, N. J.

A factory for the manufacture of a new gas generator will be put up at Wapakoneta, Ohio.

The Oswego, N. Y., plant of the Railway Steel Springs Company will be considerably enlarged.

There is a rumor that the Steele-Rudel Starch Company, of Cincinnati, may remove to Peoria, Ill.

The Dubuque (Ia.) Pearl Button Works will be enlarged and additional machinery will be installed.

A flouring mill will be erected at Bozeman, Mont., by a company of which Dr. Featherston is the head..

Chas. A. P. Barrett, of Dayton, Ohio, has formed a stock company and will erect a paint factory there.

The Fire Pulp Plastic Company will build at Los Angeles, Cal., a one-story frame factory, to cost $3,200.

Arsene Lamy will erect a factory at the southwest corner of St. Denis street and Duluth avenue, Montreal.

The Hayden-Corbett Chain Works have been organized at Columbus, Ohio, and will put up a factory there.

The Tremont Manufacturing Company, of Roxbury, Mass., may move to Johnstown, Pa., and erect a plant there.

The New York Knife Works at Walden, N. Y., are being enlarged so as to accommodate 100 more workmen.

The Everett glass works, at Johnstown, Pa., have been sold to a company, of which David Pugh is president.

W. T. Wearn, of Asheville, N. C., is interested in a company which will establish there Appalachian Print Works.

Chas. F. Dunbar is president of a company that will erect a new foundry in Buffalo. It is capitalized at $200,000.

C. E. Hitchcock is president of a company which will build a new flour mill of 500 barrels capacity at Wellington, Kan.

The Passaic Rolling Mill property at Paterson, N. J., has changed hands and its capacity is to be greatly increased.

The Minneapolis Threshing Machine Com-

pany's plant at Hopkins, Minn., will be enlarged, the addition to cost $20,000.

It is reported that the Elgin watch factory is to be enlarged by a $500,000 addition, and the force will be increased to 4,000 hands.

The Barnaby Manufacturing Company, of Fall River, Mass., will put up a new engine and boiler house to cost something over $27,500.

The Great Western Linseed Oil Mill Company will begin work on a large manufacturing plant to be erected at Minneapolis, Minn.

The Larkin Soap Company is contemplating the expenditure of nearly a quarter of a million dollars on new buildings at Buffalo, N. Y.

The Capewell Horse Nail Company, of Hartford, is providing temporary quarters in which to continue work, and will rebuild as soon as possible.

The Sanford Cotton Mill, of Sanford, N. C., is enlarging its capacity by erecting an addition to the present building which will about double its output.

The Ohio Flint Glass Company will put up a building at Lancaster, Ohio, 38x60 feet, to be used in the manufacture of fittings and trimmings for lamps.

The South Bend Watch Company will erect a watch factory at South Bend, Ind., where it is expected that eventually 1,000 to 1,500 people will be employed.

The Anderson Electric Company, of St. Louis, Mo., have completed plans for the erection of a six-story factory building, which is to cost about $125,000.

It is reported to be the intention of the Philadelphia Rapid Transit Company to build a car building establishment, in which it will make its own cars, of an improved pattern.

A new tinware plant will be built by the John Dunlap Company just outside and west of the borough of Carnegie, Pittsburgh, Pa. The two buildings to be erected will cost $50,000.

The Charles Parker Company, of Meriden, Conn., is to enlarge its foundry capacity materially. The brass foundry recently damaged by fire will be repaired and a new foundry will be erected.

Peter Kuhn, of Philadelphia, Pa., has invited estimates for a four-story brick foundry building, to measure 26x75 feet, for the Adams-Westlake Company, at 2042 to 2052 North Tenth street.

The contract for the three-story addition to the Eaton-Hurlbut Paper Company's plant on South Church street, Pittsfield, Mass., has been awarded and ground has been broken for the new building.

R. C. Berlin has designed a three-story factory, 78x115 feet, of mill construction, to be built at Twenty-fourth street, west of Wabash avenue, Chicago, Ill., for George F. Moore, at a cost of $25,000.

J. E. Durkee, president of the Consolidated Mines Company, operating in Hawthorne, Nev., says their company will put $750,000 into a mill, cyanide plant, water works, and electric plant in Tonopah mines.

C. W. Wright, who has been superintendent of the Sechler Carriage Company's factory, at Davenport, Iowa, has resigned, and it is reported will become interested in a new carriage factory to be located there.

A. R. Weins Dustless Brush Manufacturing Company expects shortly to begin the erection of a suitable factory building at West Allis, Milwaukee, Wis. The company has been organized with a capital stock of $50,000.

The Newark (N. J.) *News* says that the Manning, Maxwell & Moore Company of New York has selected a site at Garwood for the erection of a large two-story factory for the manufacture of heavy iron-working machinery.

The Ohio Motor Company, of Sandusky, Ohio, closed a contract for an addition to its factory. It will be 193x36 feet. The capacity of the company will be doubled and a number of new hands will be given employment.

Architect Edward C. Van Leyen, of Detroit, Mich., is preparing plans for a two-story brick factory of mill construction for W. J. White & Co. It will be 30x100 feet in size and will be used for the manufacture of colored show cards.

The Sheffield Car Company, of Three Rivers, Mich., will erect a new factory building 100x60, one story high, steel truss slate covered roof, with vitrified brick floor, which will enable the company to increase the number of employees from 368 to 409.

The Gum-Carbo Company, capital $1,000,000, has been incorporated at Austin, Tex., the headquarters of which will be Houston. The company will manufacture from cotton seed oil, Texas petroleum and other crude material a series of chemical products.

The Benzineated Soap Company, in which Oliver Smith, of Camden, and Alfred Lowery, of Philadelphia, are interested, has secured the building formerly occupied by the Hub Gore Factory, at Seventh and Pearl streets, Philadelphia, and will establish a soap plant.

On account of the expiration of its lease and the inadequacy of its present quarters, the C. S. Paine Company, of Grand Rapids, Mich., is figuring upon a new factory. Several sites are under consideration and a proposition to remove to a location in Ohio is also being considered.

After lying idle for nearly five years, the Chickamauga foundry property has been purchased by the Gustafson Bros. Manufacturing Company, of Sequachee, Tenn., and will be renovated and fitted up with new machinery throughout and made into an up-to-date foundry valued at about $70,000.

J. B. Duke, president of the American Tobacco Company; his brother, B. N. Duke, secretary and treasurer of the company, and George W. Watts, of Durham, one of the largest stockholders in the company, have decided to build a million-dollar cotton mill on their water power on the Cape Fear River, in Harnett County, N. C.

Mr. A. Falkenau and the Philadelphia Machine Tool Company have combined to form what is to be known as the Falkenau-Sinclair Machine Company, which will do business at 109-115 North Twenty-second street, Philadelphia, Pa., and will build machine tools, special machines and carry on a contracting machine shop business.

The Liquid Carbonic Acid Gas Manufacturing Company, of Chicago, Ill., will occupy an eight-story building to be erected at the northeast corner of Michigan and Franklin streets, 80x100 feet, where the works of the John Davis Company are now located. The Davis company is building a new plant at the corner of Halsted and Twenty-second streets and the river.

The Utica Steam Cotton Mills boarding house, at the corner of State and Spring streets, Utica, N. Y., is being torn down. The Utica & Mohawk Valley Cotton Mills are to erect on the east side of State street, between Spring and Cooper streets, a knitting mill 175x85 feet. It will be two stories high, but the wall will be heavy enough to permit future additions.

According to the Des Moines (Iowa) *Register*, J. F. Boepple will build a pearl button factory in Davenport. The Davenport Foundry & Machine Company will put up an addition to its plant 87x132. Shenandoah has granted a gas franchise and a company is organizing with a capital stock of $50,000 to put in a plant. The Webster City Council has appropriated $5,000 with which to start work on a municipal heating plant.

The New York Asbestos Manufacturing Company has purchased the old Freeman wall paper manufactory on Van Alst avenue, Ravenswood, N. Y., and the building of the sash, door and blind company on Sunswick street. The new firm will remodel the buildings and put in machinery valued at $35,000. The company is now located on Douglas street, Brooklyn, and employs about 100 men. Mr. Albert Lantzke is president.

The Giddings & Lewis Manufacturing Company, of Fond du Lac, Wis., is making plans for the complete remodeling of its foundry and machine plant, and have purchased a tract of land adjoining the factory on the north upon which they will construct a large erecting shop. Plans have been drawn for a new suite of offices which will be built at the northwest corner of the plant, and a large amount of new machinery will be installed, including a 24-ton traveling crane.

The Minneapolis Threshing Machine Company has let the contract for a boiler and iron working plant. Besides the making of threshing machine boilers, the company is going into the general business of manufacturing boilers and sheet iron and sheet steel products, including elevator and mill work. The new plant is to cost $75,000, and when finished will employ about sixty men. The company has also let the contract for ten new dwellings to be sold to the employees at cost on agreed terms.

The National Rolled Steel Car Company, backed principally by Pittsburgh capitalists, has secured a site near Mercer, Pa., and will erect big car works. The company is capitalized at $600,000. The company will manufacture all kinds of steel cars from rolled steel, and claims to have orders booked aggregating more than $1,500,000, or sufficient to keep the works in operation until January 1, 1904. More than 1,000 men will be offered employment. C. M. Carnahan, of Pittsburgh, is at the head of the company.

The Waltham Screw Company, Waltham, Mass., has completed an addition to its factory, necessitated by the increase of its business. The plant will be much benefited, as all the extra space is added to the working section and will be taken up by machinery. Among the products manufactured by this company are watch and instrumental screws, studs, collets, bushings, pinions, shafts for electrical and steam gage work, and parts of firearms and scientific instruments. The business has prospered the last few years and markets in all parts of the world have been secured.

The American Valve & Meter Company, Cincinnati, O., referring to our item at page 1065, state that it is incorrect and send the following statement: "Our company is incorporated with an authorized capital of three hundred and thirty thousand dollars ($330,000) for the purpose of purchasing the old-established plants of the John N. Poage Manufacturing Company and the Cincinnati Meter Company, and will continue the manufacture of water cranes, tank outlet valves, iron and brass body globe and gate valves, railway supplies and water meters. The incorporators are N. Paul Fenner, Jr.; Wm. Porteous, Frank M. Foster, D. S. Marfield and Chas. E. Prior.

Announcement is made of the resignation of Thomas F. Anderson, of East Liverpool, O., as district superintendent of the American Pipe Company, of Pittsburgh, Pa.; also of the resignation of Captain James Porter, general manager of the paving brick plants

operated by the company. It is reported that Mr. Anderson proposes to ally himself with a company that will erect a large plant in Western Pennsylvania, which will be operated independent of the trust. Captain Porter is known to have asked at Pittsburgh for bids for machinery for an independent plant for the manufacture of paving brick, and with associates is understood to be about to erect such a plant in this section of the Ohio valley.

The Omaha (Neb.) *News* of July 14 says: "Omaha will probably get a branch of the Featherstone Iron Foundry, of Chicago. A proposition from the company to establish a foundry here, in order to settle the difficulty with the Union Pacific, was refused by the local molders' union because no time was specified when the foundry would be built. The proposition has been accepted by the convention of the international union of the molders, which is meeting in Toronto, Canada. The Featherstone people agree to build a foundry here that will use from 35 to 40 tons of material a day, to employ all of the former Union Pacific molders, helpers and apprentices when completed, and until that time to give them work at Chicago. The minimum wage scale is to be 32½ cents an hour. It is not likely that many local molders will take advantage of the offer of work in Chicago, as their homes are here. No time is specified when the foundry will be built."

With the idea of preparing for the starting of the new car works in October the Standard Steel Car Company has begun to build a large number of houses for its employees in close proximity to its new plant at Butler, Pa. A subsidiary corporation to the car company was formed, called the Lyndora Land Company. This company has plotted 150 acres of the 300 acres of land of the car company and laid out 50-foot streets, grading and paving them and putting in sewers, water and gas. During the past week contracts were awarded for the building of 200 modern dwelling houses, which will be owned by the company and rented to the workmen. The houses are divided into two classes, 125 to contain six rooms and bath and the rest five rooms. The workmen can buy them if they desire. Each house will have a lot 50x110 feet. It is claimed that the plans for this new settlement will make it the most modern and complete ever attempted by a large industrial establishment of this kind.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.

Punches & Dies. Wal. M. Wks., Waltham, Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Stamping Dies. Emmons Collins, Chicago.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N.J.

Book, "Dies and Diemaking," 100 6x9 pages, $1, post paid; send for index. J. L. Lucas, Bridgeport, Conn.

Chicago dealers want agency; hardware, machinists', engineers' supplies. Address Box 734, AMERICAN MACHINIST.

Will sell patented article, or will consider formation of company with same. A rare chance. Address "Variable Speed," AM. MACH.

F. L. Stokes Machine Co., 13th and Noble sts., Philadelphia, cut light gears, cams and duplicate small machine parts, in quantities.

Wanted—An automatic gear cutter to cut not less than 24 in. in diameter, 4 diametrical pitch. Address F. X. Hooper, Glenarm, Md.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Will sell interest in small shop centrally located in Philadelphia, or will sell entire effects of same. Fine tools and bargain to cash buyer. Box 728, AMERICAN MACH.

Wanted—One or two lines of machinery or supplies on commission in Chicago and vicinity by experienced salesman now covering this territory. Box 721, AM. MACH.

Gear and milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears, catalog of small tools free. R. M. Clough, Tolland, Ct.

Manufacturers, have you ever used Ironhard to harden iron and machinery steel, also steel; it will make iron as hard as steel; box 25 cents, 150 lbs. Grahner Co., 113 Hopkins st., Brooklyn, N. Y.

For Sale—Machine shop and foundry with a well-established business, long standing and good reputation; located in a city of 30,000 inhabitants; best of shipping facilities; good reason for selling. Address F. M., care A. M.

Wanted to buy, complete machine, newest construction, to manufacture wooden blocks for shoe-nailing machines. Send lowest offers with explanations or directions of this machine to L. 941, Haasenstein & Vogler, Breslau, Germany.

$5,000 capital, or established company in the East, to introduce new line of small machinery, involving considerable screw machine work on 2-inch stock; passed experimental stage; good field. Address Box 737, AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

Specialties Wanted—Having a complete plant, consisting of foundry, machine and pattern shops and good workmen with excellent materials, we solicit special work; we can employ 20 more men readily. Address Box 725, AMERICAN MACHINIST.

Owing to the death of one of the active members of a machine and foundry business (incorporated for $100,000) the present management wish to find a man with a thorough knowledge of the business, that would take hold with energy and invest some capital; This is a rare opportunity for the right man; paper and pulp mill machinery a specialty. Address M. & F., care AMER. MACHINIST.

For Sale—Interest in centrally located shop in Philadelphia, or will sell tools, consisting of one Hendey Universal Milling Machine No. 2, used six months; one Hendey 18 in. x 8 ft. Lathe (taper attachment and compound rest), used six months; one Fosdick 21-inch Drill Press (automatic feeds), used one month. Other tools, large and small; perfect condition. What am I offered? Box 724, AMERICAN MACHINIST.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

First-class mechanical draftsman desires a position. Box 714, AMER. MACH.

Machine tool draftsman, 3 years' experience, wants change. Box 716, AM. MACH.

Experienced mechanical draftsman wishes position near New York city. Box 706, A. M.

Foreman, wide experience, open for engagement. T. J. Keller, 286 E. Huron st., Chicago.

Position as superintendent or general foreman; A 1 references as such. Box 718, A. M.

Mechanical draftsman with practical shop experience desires position. Box 715, A. M.

Mechanical draftsman seeks position in New York. Box 732, AMERICAN MACHINIST.

Cost, stock, entry, foundry and time clerk; 5 years' experience. W. L., care AM. MACH.

By a practical, experienced man, charge of fine manufacturing. Box 742, AMER. MACH.

First-class metal pattern maker (understands molding machine) wants position. Box 681, AMERICAN MACHINIST.

Wanted—Drafting-room work by thorough student who has had some experience. H. E. Brownson, Kalamazoo, Mich.

Mechanical draftsman, technical graduate, 27 years of age, 6 years' experience, wants position. Box 713, AMER. MACH.

Open for engagement, machine shop foreman of broad experience; energetic and reliable. Box 719, AMERICAN MACHINIST.

Situation wanted by a machinist with 12 years' experience on engine, pump, electrical and tool work. Address Box 741, AM. M.

Mechanical draftsman (23), 4½ years' shop and 3 years' office experience, boiler and engine works, wants position. Box 730, A. M.

First-class mechanical draftsman for all kinds of heavy machine tools and hydraulic machinery wants position. Box 735, AM. M.

Draftsman—A practical man on general machine work, jigs and fixtures, with shop experience; American; age 25. "Reliable," care AMERICAN MACHINIST.

German, age 24, desires a steady position as draftsman; has 10 years' practical experience in machinery. Address Max O., 356 Smallwood st., Baltimore, Md.

Wanted—Responsible position, not in drafting room, by graduate, 31, now with steel company, and experienced as draftsman and foreman. Box 743, AMERICAN MACHINIST.

Designer of special machinery and tools for metal working and manufacturing purposes. A middle-aged "Westerner" with ability and experience for difficult work. Moderate wages. Box 717, AMER. MACH.

$2,000 factory manager, age 32, practical and technical, open November 1; interchangeable parts a specialty; automobiles, gasoline and steam engines, dynamos, electrical parts. Address M. L., care AMERICAN MACHINIST.

Mechanical engineer and draftsman wishes to change in September. Technical education. Large experience as foreman, master mechanic and superintendent manufacturing small and medium interchangeable machinery and fine steel instruments. Box 712, A. M.

As manager or superintendent, by practical mechanic; large experience with work and men; keen executive; good past record; first-class reference; at present well employed, but wishes to become connected with more progressive firm. Box 731, AM. M.

Mechanical engineer, for the last ten years in responsible charge with good engineering concerns, would like to change. At present M. E. for large concern in Middle West. Technical education; shop experience; member A. S. M. E.; age 40, married. Address Box 720, AMERICAN MACHINIST.

Help Wanted.

Wanted.—First-class patternmakers wanted at Reeves Engine Co., Trenton, N. J.

Toolmakers wanted at once. Murray Mfg. Co., Richmond Valley, Staten Island, N. Y.

Wanted—Half-dozen good machinery molders. Southern Foundry & Machine Co., Knoxville, Tenn.

Wanted—Machinists to increase income; congenial work in leisure moments. Box 727, AMERICAN MACHINIST.

Wanted—Three or four good patternmakers. Address Ridgway Dynamo & Engine Company, Ridgway, Pa.

Wanted—Experienced brass molder who can mix his own metal; N. Y. district. Box 722, AMERICAN MACHINIST.

Wanted—A first-class wood pattern maker; ten hours day; wages 30c. per hour. Address Wm. E. Hill & Co., Kalamazoo, Mich.

Wanted—Every shop agent in the U. S. (no Canada agents wanted) to read my advertisement on page 105. E. H. Randall.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—First-class lathe and machine hands at The Reeves Engine Company, Trenton, N. J. Steady work and good wages to first-class men.

Wanted—Ten good patternmakers at once; new shop and equipments; good wages. The Baikwill Pattern Works, 970 Hamilton st., Cleveland, Ohio.

We want several first-class floor hands, fitters and scrapers on machine tool work; also a few good lathe hands. De Laval Steam Turbine Co., Trenton, N. J.

Wanted—Good mechanical draftsmen in New England States; write age, education, experience and salary expected. Address Box 736, AMERICAN MACHINIST.

Draftsman, mechanical; young man accustomed to small detail work preferred; give experience, references and salary expected. Marshall-Sanders Company, Boston.

Wanted—A mechanical draftsman with experience on machine tools and special machinery; state wages expected. "Worcester County," care AMERICAN MACHINIST.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—Immediately, additional general machinists, also automatic screw machine operators; good wages and steady work. The National-Acme Mfg. Co., Cleveland, Ohio.

Wanted—A competent foreman to take full charge of sheet metal drawing, forming and punching department; state wages expected and experience. Address Box 680, AM. M.

Wanted—First-class toolmakers, experienced on punch and die work; must also be first-class men on general work; state experience, also wages expected. Richmond Electric Company, Richmond, Va.

A skilled draftsman, experienced in designing medium automatic machinery, to assist principal designer; please state age, experience, references and pay asked. Address Box 738, AMERICAN MACHINIST.

Wanted—Three first-class machinists, accustomed to tool and jig work; permanent position for suitable man. Address, stating age, experience and wages expected, H. W. H., care AMERICAN MACHINIST.

Wanted—A few first-class machinists familiar with erection and running of oil and gas engines, for shop and outside work; state experience and salary expected. Address "Oil Engine," care AMERICAN MACHINIST.

Toolmakers Wanted.—Two A1 toolmakers on small interchangeable parts of machines, an apt young man on B. S. No. 1 universal grinder and surface grinder; must give reference, age, wages expected. Box 740, AM. M.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—Representatives in several of the leading cities to sell, on commission, high-grade automatic engines; modern designs; none but thoroughly experienced salesmen need apply. Address "Engine Builder," care AMERICAN MACHINIST.

Wanted—Several experienced draftsmen, by a large concern in New York; those experienced in iron framework preferred; permanent positions to the right men; state age, experience, salary expected and references. Box 733, AMERICAN MACHINIST.

Reputable Cleveland firm wants a man capable to take charge of about 25 power punch presses, making stampings from brass and steel; wants to be able to handle help to the best advantage; state age, experience and salary. Box 739, AMERICAN MACHINIST.

Wanted—A man between 25 and 30 years of age, who has served his time in a machine shop and had a good scientific education, to take charge of a small shop running on high-class work in connection with a prosperous business. Box 729, AMER. MACH.

Wanted—A first-class mechanical draftsman, experienced at designing and making practical working drawings so clear and explicit as not to require verbal explanations; will consider only applications from parties at present employed by some successful concern. Address, giving references, experience and salary expected, Box 726, AMER. MACH.

Machinist Wanted.—To keep pace with our rapid growth we need an additional number of experienced machinists; we want steady men of good habits, looking for permanent positions; school, home and health advantages of Madison are unsurpassed; write immediately for particulars; state age, experience, etc. Northern Electrical Mfg. Co., Madison, Wis.

Paint and assembling foreman wanted; a competent and experienced foreman for painting and assembling department of an agricultural implement factory; none but thoroughly experienced need apply; must be able to devise plans and methods of getting work out in excellent shape and at the least possible cost; give age, reference and salary expected. Address Box 695, AMER. MACH.

Draftsman wanted; experienced man who has done practical work in modern plants, familiar with up-to-date methods, who can design jigs and fixtures for interchangeable work, by a firm in Paris, France, making engines and dynamos; steady position to the right man; must speak some French; state experience and references fully, nationality, age and salary expected, with time of entry. Address Box 723, AMERICAN MACHINIST.

Wanted—A machinist who has been used to planning and directing work, or a working foreman; one having experience in the line of special machines preferred; the work is principally to look after and improve the mechanical end of a leather working establishment having its own machine shop; only mechanics having executive ability need apply; should have some technical education; good wages and permanent employment; state age, married or single, advise fully about experience, wages expected, and refer us to former employers for recommendation. Address Williamsport Staple Co., Williamsport, Pa.

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Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Byram & Co., Detroit, Mich.
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Philadel., Pa.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutting off Tools
Armstrong Bros Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Cyclometers
Veeder Mfg. Co., Hartford, Conn.

Diamond Tools
Dickinson, Thos. L., New York.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
Wold & Co., Torris, Chicago, Ill.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

Drafting Machine
Universal Drafting Mach. Co., Cleveland, O.

Drawing Boards and Tables
Alexander Mfg. Co., J. G., Grand Rapids, Mich.

Drawing Instruments
Keuffel & Esser Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Sphingfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Fenn-Sadler Mach. Co., Hartford, Conn.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Gang Co., Wm. E., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Dwight Slate Mach. Co., Hartford, Conn.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Rhoades Mfg. Co., Columbus, O.
Sibley & Ware, South Bend, Ind.
Snyder, J. E., Worcester, Mass.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dust Collectors
Allington & Curtis Mfg. Co., Saginaw, Mich.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrically-Driven Tools.
Clark, Jr., & Co., Jas., Louisville, Ky.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Howard Iron Wks., Buffalo, N. Y.
Morse, Williams & Co., Phila., Pa.

Emery Wheel Dresser
Dickinson, Thos. L., New York.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Stover Engine Wks., Freeport, Ill.
Struthers, Wells & Co., Warren, Pa.

Engines, Steam
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Chandler & Taylor Co., Indianapolis, Ind.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.

Exhaust Heads
Burt Mfg. Co., Akron, Ohio.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.

Filing Machines
Cochrane-Bly Mach. Co., Rochester, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Filters, Oil
Burt Mfg. Co., Akron, O.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.
Stow Mfg. Co., Binghamton, N. Y.

Forges
Buffalo Forge Co., Buffalo, N. Y.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Westmoreland Steel Co., Pittsburgh, Pa.
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Byram & Co., Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Philadel., Pa.
Smith Fdry. Supply Co., J. D., Cleveland, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dwight Slate Mach. Co., Hartford, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wk., Phil., Pa.
Niles Tool Works Co., New York.
Walcott & Son, Geo. D., Jackson, Mich.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Chicago, Ill.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Hardinge Bros., Chicago, Ill.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
Messmer Mfg. Co., Ferd., St. Louis, Mo.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Turley Mfg. Co., J. G., St. Louis, Mo.
Walcott & Son, Geo. D., Jackson, Mich.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Browning Mfg. Co., Milwaukee, Wis.
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Hisey-Wolf Mach. Co., Cincin., O.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.
Russell, R. M., Binghamton, N. Y.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Blount & Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Hisey-Wolf Mach. Co., Cincin. O.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Russell, R. M., Binghamton, N. Y.
Safety Emery Wheel Co., Springfield, Ohio.
Tanite Co., Stroudsburg, Pa.
Vitrified Wheel Co., Westfield, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Tanite Co., Stroudsburg, Pa.
Vitrified Wheel Co., Westfield, Mass.

Grindstones
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Daimond Saw & Stamping Wks., Buffalo, N. Y.
Hoefer Mfg. Co., Freeport, Ill.
Olmsted, L. H., Hasbrouck Heights, N. J.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Merrill Bros., Brooklyn, N. Y.
Williams, White & Co., Moline, Ill.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.

Handles, Machine Tool
Norwood Mach. & Mfg. Co., Cincinnati, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Holders, File and Tool
Bowers, Geo. W., Waltham, Mass.

Igniters, Gas Engine
Maxwell Engr. Co., Rome, N. Y.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.
Woodman Mfg. & Supply Co., S., Boston, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Injectors
Lunkenheimer Co., Cincinnati, O.
Rue Mfg. Co., Philadelphia, Pa.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Insurance, Boiler
Hartford Steam Boiler Insp. & Ins. Co., Hartford, Conn.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Hill Tool Co., Anderson, Ind.
Mitts & Merrill, Saginaw, Mich.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blount & Co., J. G., Everett, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Tanite Co., Stroudsburg, Pa.
Shepard Lathe Co., Cincinnati, O.
Walcott & Son, Geo. D., Jackson, Mich.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Fenn-Sadler Mach. Co., Hartford, Conn.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Boring
Streit Mach. Co., A., Cincin., O.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Mass. Tool Co., Greenfield, Mass.
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rowbottom Macn. Co., Waterbury, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Special Machinery Co., Bridgeport, Conn.
Stowell, J. A., Leominster, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Mass. Tool Co., Greenfield, Mass.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Randall, E. H., Springfield, O.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Turner & Co., F. L., Orange, Mass.
Wyke & Co., J., East Boston, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Syracuse Twist Drill Co., Syracuse, N. Y.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Prov., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Molds, Hammer and Vise Jaw
Field, Chas. H., Providence, R. I.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Electric Co., New York.
Stow Mfg. Co., Binghamton, N. Y.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.
Murdock Parlor Grate Co., Boston, Mass.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Lathe
New Britain Mach. Co., New Britain, Conn.

Pans, Shop
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Field, Chas. H., Providence, R. I.
Greaves, Klusman & Co., Cin., O.
Marston & Co., J. M., Boston, Mass.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Gobeille Pattern Co., Cleveland, O.
Lorentz & Evarts, Hartford, Conn.
Olmstead & Co., H. B., New York.
Topping, Jas. R., Hartford, Conn.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Stevens & Co., Milo B., Washington, D. C.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Pipe Cutting and Threading Machines
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers, Portable
Morton Mfg. Co., Muskegon Heights, Mich.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Planers
American Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Presses, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.
Wold & Co., Torris, Chicago, Ill.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Streit Mach. Co., A., Cincin., O.

Pulleys
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Howard Iron Wks., Buffalo, N. Y.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mch. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.
Walcott & Son, Geo. D., Jackson, Mich.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Walcott & Son, Geo. D., Jackson, Mich.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Reamers
Chadwick & Co., G. B., Portsmouth, N. H.
Cleveland Twist Drill Co., Cleveland, O.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting
Cooke Machinery Co., New York.
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
American Roller Bearing Co., Boston, Mass.
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sand Blast Apparatus
Paxson Co., J. W., Philadel., Pa.

Sand Mixing Machines
Smith Fdry. Supply Co., J. D., Cleveland, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Marston & Co., J. M., Boston, Mass.
Newton Mach. Tool Works, Philadelphia, Pa.
Nutter, Barnes & Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.
West Haven Mfg. Co., New Haven, Conn.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
State College of Kentucky, Lexington, Ky.
Pratt Institute, Brooklyn, N. Y.
Purdue University, Lafayette, Ind.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegheny, Pa.
Dawson, John H., Chicago, Ill.
Fairbanks Co., New York.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Gump & Co., A. W., Dayton, O.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Standard Roller Bearing Co., Philadelphia, Pa.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.
York Mchry. Co., S. M., Cleveland, O.

Separators, Oil
American Tool & Mach. Co., Boston, Mass.
Springfield Separator Co., Springfield, Vt.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Blount & Co., J. G., Everett, Mass.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Steptoe & Co., John, Cincinnati, O.
Walcott & Son, Geo. D., Jackson, Mich.

Shapers, Vertical Die
Rochester Die Shaper Co., Rochester, N. Y.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Nues Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Springs
Dunbar Bros., Bristol, Conn.

Sprocket Chains
See Driving Chains.

Squares
Turner & Co., F. L., Orange, Mass.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
Hermann Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriache & Bell, New York.
Westmoreland Steel Co., Pittsburgh, Pa.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Straightener, Screw
Towsley Mfg. Co., J. T., Cin., O.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Fulton Fdry. & Mach. Co., Brooklyn, N. Y.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hardinge Bros., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Trucks, Shop
Towsley Mfg. Co., J. T., Cin., O.

Tubing, Steel
Shelby Steel Tube Co., Pittsburgh, Pa.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
American Tool & Mach. Co., Boston, Mass.
Automatic Mach. Co., Greenfield, Mass.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Foster, Walter H., New York.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.
Gray & Prior Mach. Co., Hartford, Conn.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Hopkinson Mach. Wks., Springfield, Mass.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Howard Iron Wks., Buffalo, N. Y.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Emmert Mfg. Co., Waynesboro, Pa.
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding, Electric
Standard Welding Co., Cleveland, O.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.
Special Machinery Co., Bridgeport, Conn.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

A Special Radial Drilling Machine.

The accompanying half-tones illustrate a special radial drill which was recently furnished by the Bickford Drill and Tool Company, of Cincinnati, to the works of the Dodge Manufacturing Company, of Mishawaha, Ind. The tool is intended for use in the construction of large, segmental, rope-driving wheels, one of which is shown in Figs. 2, 3 and 4 in process of construction in the shops of the last-named company, to whom we are indebted for the interesting shop pictures. The wheel shown is of 20 feet diameter and 45½ inches face width. It is to carry seventeen 1¾-inch ropes and will weigh about 55,000 pounds.

Referring to Fig. 1, the drilling machine will be seen to have no base, but instead a turned taper stump at the lower end of the column, which is intended to fit corresponding bushings which, externally, fit the bore in the wheel hubs. The drive is electric, the motor being mounted in a very neat way at the top of the column. Except for the base and such changes as are necessitated by the location of the motor, the machine is the standard "New Radial" of the Bickford company. The motor is a constant-speed machine and by means of nests of gears operated by hand levers eight changes of speed are obtained, the changes being practically instantaneous.

Fig. 2 shows the rope wheel in process of assembling its parts. The attachment of the arms to the segments of the rim will be observed to be of an unusual construction. Figs. 3 and 4 show the drilling machine at work drilling and reaming the hub holes. In the present case there are thirty of these holes, which are 2 inches in diameter. Of these, twenty are through 13 and ten are through 23 inches of metal, making a total of 40 feet 10 inches of drilling from the solid. The machine is also used for drilling the holes for the bolts joining the arms with the segments. For this work the machine is mounted on a small base which is bolted to the floor plate between the arms and thus reaches the holes at the ends of the two arms at one setting.

Our readers will note the use of the floor-plate-portable-tool system in doing this class of work. Incidentally we may remark that an unusually large rope wheel is shown in segments in the rear of Fig. 2—one complete section being in the pit lathe. When the sections are assembled on their shaft they will make a wheel of 22 feet pitch diameter and of 11 feet 2½ inches face width.

According to a recently issued Consular report, there were in Germany 1,071 strikes during 1901, involving 141,220 persons, as against 1,462 strikes of 298,819 persons in 1900. In 200 cases in 1901 the strikes were successful, in 285 cases they were partially successful, and in 571 cases they failed.

The Red Ticket.

"What do you think of Fraser & Chalmers' red ticket?" This was the question that a certain cost keeper in a prominent Ohio machine shop found in his shop mail box one day. The question came from the proprietor, and we have quoted above every word on the slip of paper containing it. It gave no hint of what was meant by Fraser & Chalmers' red ticket nor where information about it could be obtained; but the cost keeper knew what it meant. He knew that the "Old Man" was not seeking light about the ticket at all, but was after information of a very different character.

You see this particular shop proprietor not only believes in making use of every possible modern means of improving the efficiency of his shop, but he believes that the men who are employed about the place in responsible positions should also make use of them. In talking with them on this subject he is in the habit of saying: "I cannot be a specialist in all the different branches of this work, nor in fact in any of them. You must not expect me to tell you things pertaining to your various special lines of work. On the contrary, I expect you to be always able to tell me things about these different branches. You are specialists in them; I cannot be."

And so the cost keeper knew that if he were not able to immediately give an intelligent opinion regarding that red ticket there would be more or less trouble. For a few days he hunted and inquired and dreamed about tickets of various colors, but was at last reduced to the desperate expedient of going to the questioner and attempting to draw him out without "giving himself away." This failed to work, and after some appropriate remarks calculated to impress still stronger upon his mind the fact that he was expected to know about such things he was informed that Fraser & Chalmers' red ticket was mentioned and its uses described in an

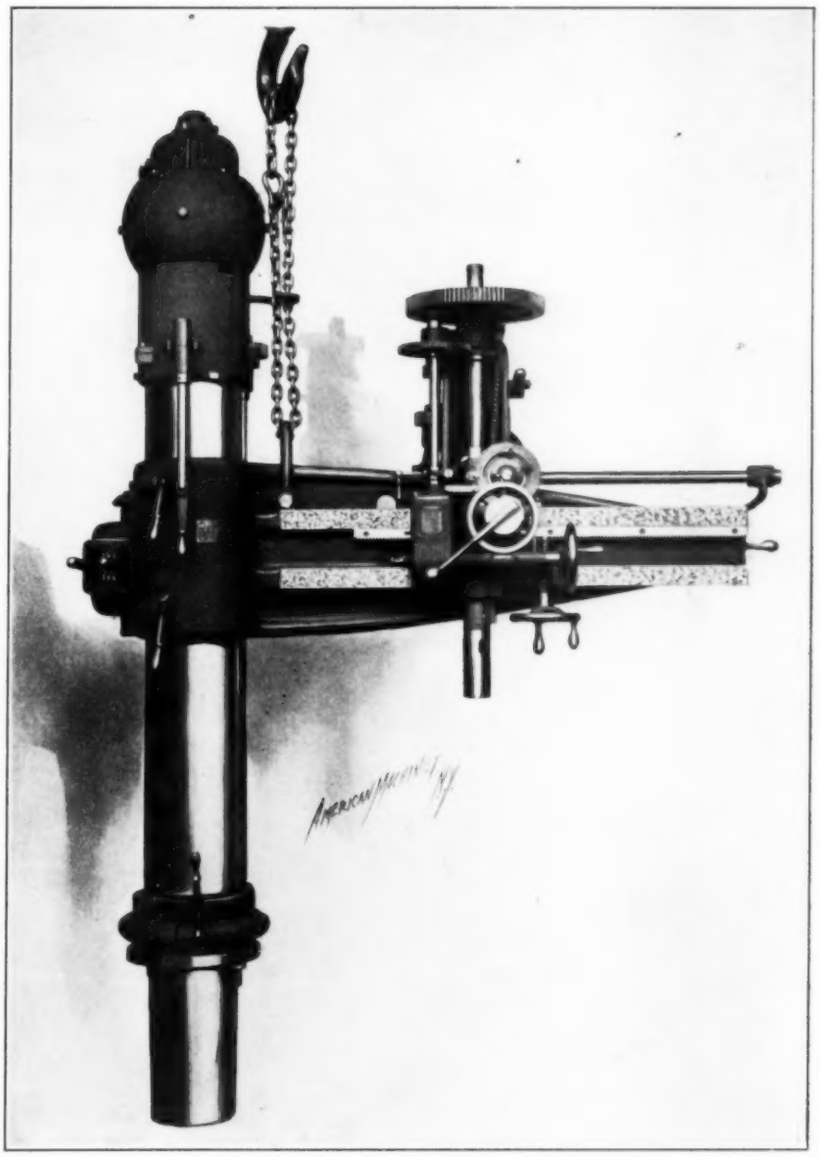


FIG. 1. SPECIAL RADIAL DRILLER.

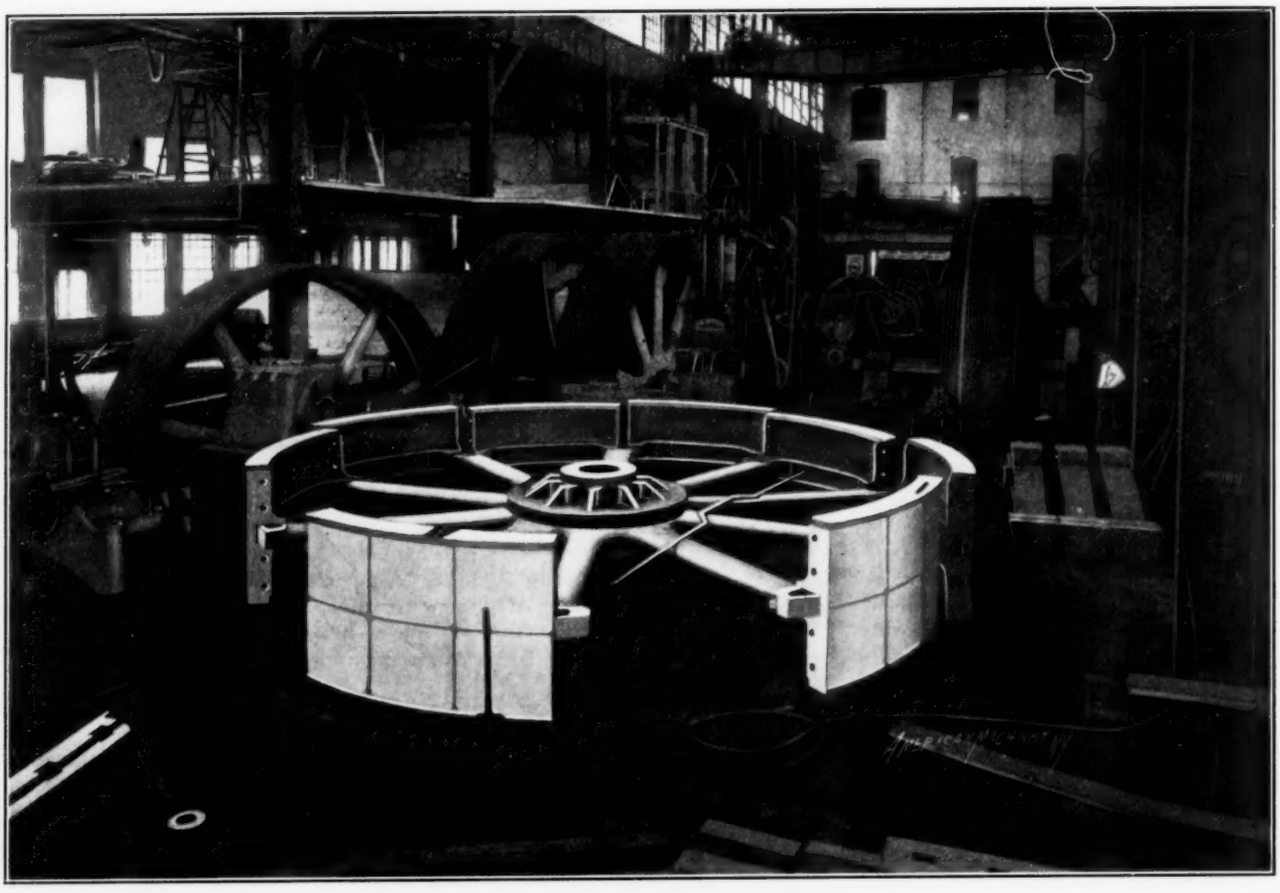


FIG. 2. ROPE WHEEL IN PROCESS OF ASSEMBLING.

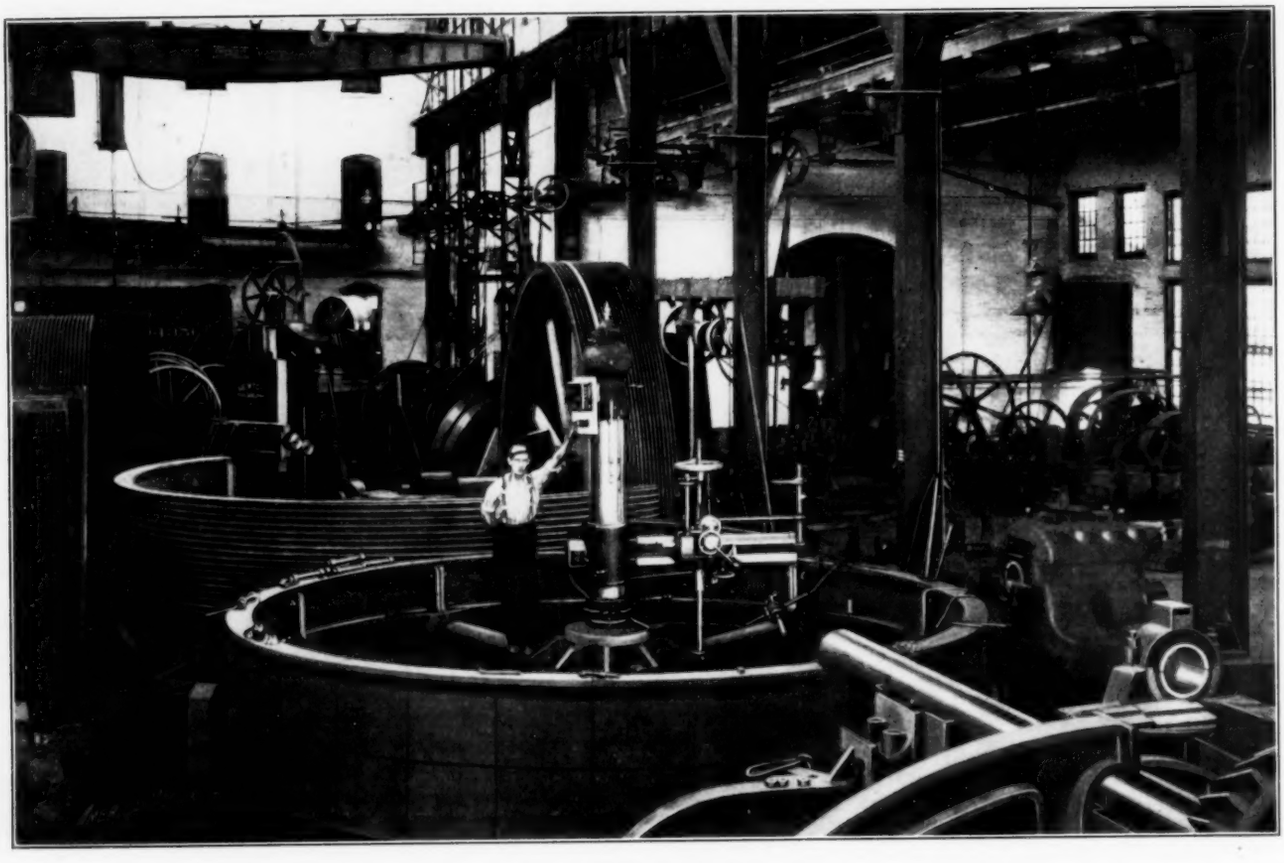


FIG. 3. DRILLING THE HUB.

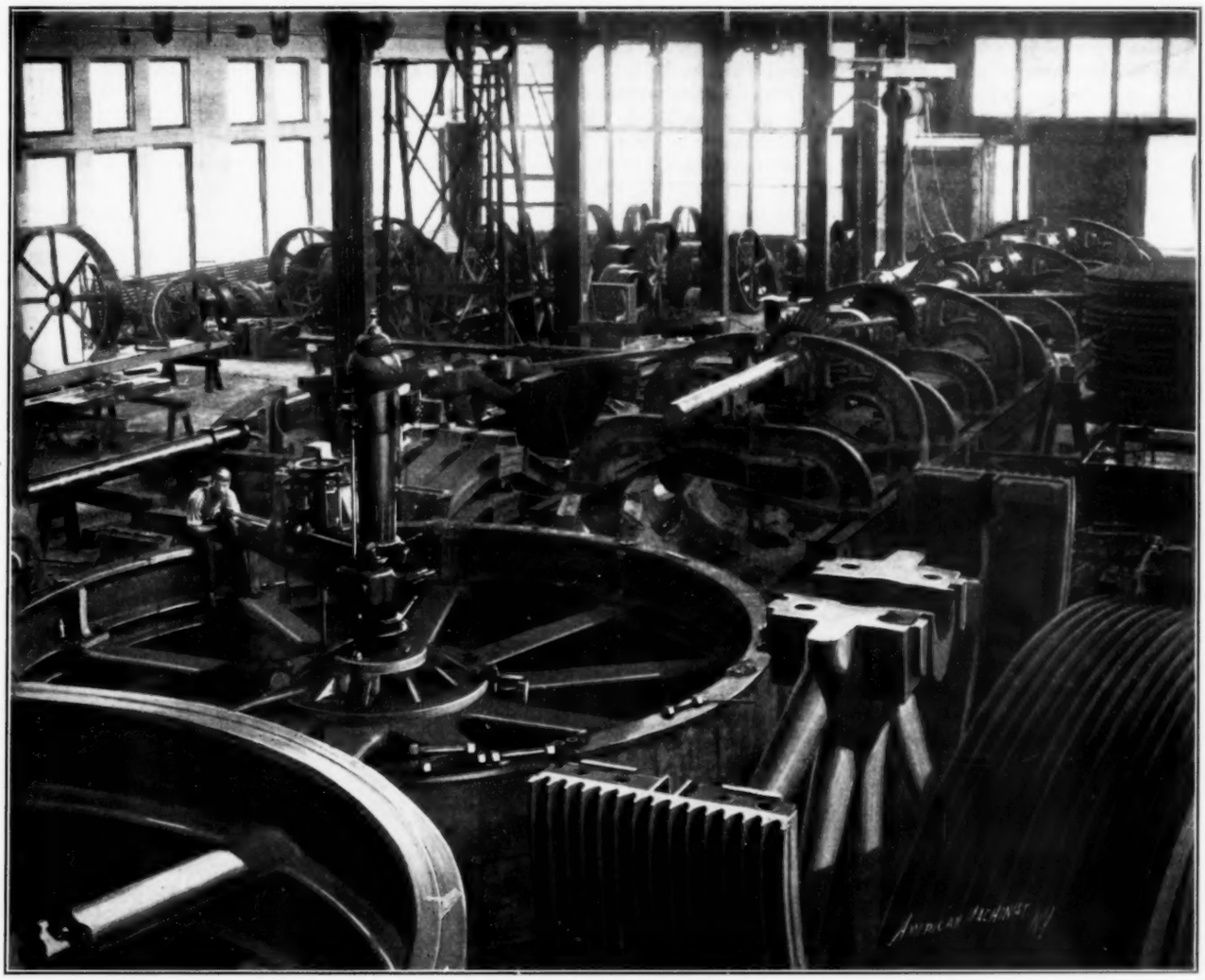


FIG. 4. DRILLING THE HUB.

article by J. A. Thomas in the AMERICAN MACHINIST on a shop cost-keeping system, which article should have been read by every man making any pretensions to being well informed on the subject, or competent to have charge of such work. The paper had been received and was accessible at any time, and there was no excuse for a man responsible for the cost keeping department of the works not being familiar with the article.

A new machine was to be built in the same shop, in which machine was to be included some important worm gearing. The proprietor let the drafting room go ahead on the job for a few days and then, "dropping in," he said to the man who was doing the scheming: "I see you are getting along with the preliminary work, and that worm gearing looks as though it would drive all right, but what relation have you between the thread-angle and the speed?" The schemer said he hadn't figured that out, but, making a few figures, he said: "The pitch angle is slightly over 10 degrees and ——" "Well, what efficiency do you expect to get from that gearing?"

"I don't know just what efficiency to expect, but that is the ratio of reduction we want, and I don't believe there is much definite information on efficiencies. The books don't give it, but of course we know that worm gearing is at best very inefficient."

"Well," said the proprietor, "it is evident that you have not seen the latest thing on the subject. Yet it is here at hand for your use. Suppose you were running a shop and had a man upon whom you depended for such work as this and you were paying him a high salary for doing it. And suppose you found that in such a job as this he simply went ahead and laid out an important machine without reference to available data of the utmost importance. What would you think? Now in the AMERICAN MACHINIST, published some time ago, are some articles on worm gearing by Mr. Halsey giving drawings and full particulars of a large number of worm gears that were unsuccessful, and drawings and particulars of a lot more that were entirely successful. From these examples of experience certain laws are deduced regarding the design of worm gears, and the lines within which worm gearing can be expected to work satisfactorily are pretty definitely laid down. Outside those lines worm gearing is shown, by the experience cited, to be sure to range from only fairly workable to total failure, depending upon how far the designer has happened to stray outside of the boundaries referred to. Your worm, as you have it laid down, is outside the limits of good practice just far enough to make it sure that there will be trouble with it, and by simply reducing the diameter of the worm, leaving its pitch and the ratio of reduction the same, you would bring it well within the bounds of practical satisfactory working. It seems to me it is to your own interest to know such things as this and that you should find out what information is available before laying out a machine which will cost from five to eight thousand dollars, and in which a mistake of that character might mean the difference between satisfactory working and total failure."

Here spoke the real friend of the AMERICAN MACHINIST. That is to say, a man who, though "busy," reads it sufficiently at least to know what is to be found within its pages; keeps it on file and takes steps to insure that men in positions of responsibility about his place make use of it.

We have many such friends, but not as many as the machinery-building establishments of the country ought to afford us. Most of those we have are in the best shops—the shops where the best men are employed and where, if need be, they could best afford to get along without the ideas of other people and without knowing what others are doing or how they are doing it. The men who sign advertising contracts are of course valued as appreciative friends, but the success of such a journal as this depends far more upon the number of such friends as the one referred to above that it can attract and retain.

German Facing Machines.

The accompanying half-tones and line engraving illustrate two facing machines built by Gustav Wagner, Reutlingen, Wurtemberg.

The machine shown in Fig. 1 is made for squaring the ends of beams, rails, channel bars, etc. It has a head 31½ inches in diameter fitted with four facing cutters. This head is mounted on a spindle which is 8 inches in diameter and which runs in long bearings provided with means for taking up wear. The spindle is driven by means of a worm wheel and worm, the worm shaft carrying tight and loose pulleys which are driven direct from the main shaft. The cutter head may be fed out by hand, or automatically, the feed screw being rotated by gearing operated by the hand wheel, or by the ratchet wheel and pawl shown on top at the left of the head. The feed is readily changed to suit the work.

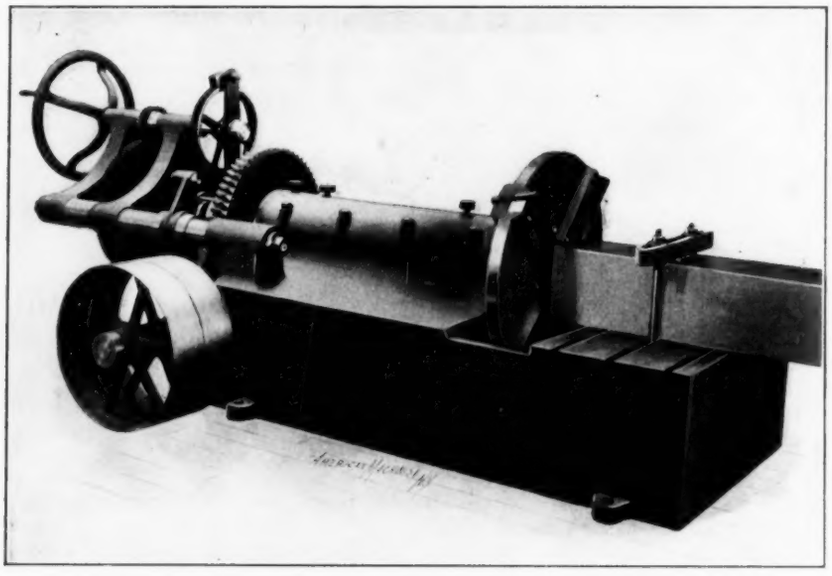


FIG. 1. FACING MACHINE.

Figs. 2 and 3 show a facing machine fitted with a traveling head. The arrangement of the driving gear and feed for the cutter head is the same as in the machine shown in Fig. 1. The head may be moved along the bed in either direction by hand or by power, the feed screw and the manner in which it is driven being clearly shown in the illustrations.

There is little time lost in shifting work on this machine, for, while one piece is being machined, another piece may be clamped in position; the head may then be moved along to finish the screw piece. By putting on a milling cutter in place of the facing head, the machine may be used as a rotary planer. The table for holding the work is 78 inches long and 19 inches wide.

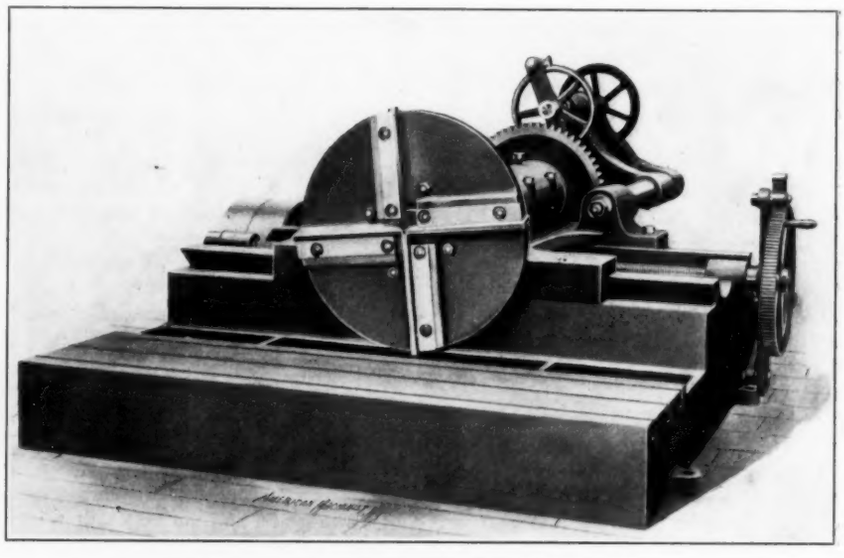


FIG. 2. FACING MACHINE WITH TRAVELING HEAD.

The Metric System.

Mr. E. W. Mix, who is at present the chief engineer of the Société des Estabs. Postel-Vinay, manufacturers for the French Thomson-Houston Company, first served an apprenticeship at the Thomson-Houston Company at Lynn, Mass., and a number of years ago was sent over to Paris, where he formed a connection with M. Postel-Vinay, of the company named above. An American friend of Mr. Mix suggested that he would be an excellent person to express an opinion regarding the relative merits of the metric and the English system of measuring for shop purposes, as he had had experience in the construction of machinery by both systems. We accordingly addressed a letter to Mr. Mix asking him to give us an expression of his views on the subject, in reply to which he states that having been a little out of health recently, work has accumulated to such an extent that he feels it to be impossible to assume additional burdens; but it is significant that he states in his letter that he would be very glad if he could write us an article giving the advantages of the metric system. He says: "This is an interesting subject, and I am convinced that the metric system presents enormous advantages over the system in use in the United States." This opinion must, of course, be accepted as quite significant in view of the fact that Mr. Mix's earlier experience was in America and that he had afterward to learn the metric system. Evidently he has become convinced by his experience that the metric is much the superior one.

Echoes from the Oil Country.

A HOME-MADE LATHE INDICATOR.

One day a man dropped in with an indicator. Not a steam indicator, but one of those instruments that reveal how much out of round you are turning those nice bearings; that tells how many thousandths you should spring that saw arbor to have it straight; that tells a whole lot of tales that you don't want to have it possible to tell.

This man was not the first man who had been around with such an instrument. The first one came at a time when such a thing did not appeal very strongly to any unfilled want, but before the second one came I had begun to feel the need of it.

Like most things in this world, this

indicator was not perfect, though very good for many purposes, and I had made up my mind to get one—until the man along with it began to talk. He had made it, and after singing its praises he passed on to the people who would not buy it. He intimated quite plainly that this indicator would tell when a man was a mechanic, would show how fit he was to be in charge of decent work, would let him know a real mechanic from a bluffer or an impostor, and more of the same. Furthermore, its possession meant merit and advancement and the cream of the business.

By a strange perverseness I changed my mind and let him depart without placing my name on the roll of those predestined to succeed and without adding my dollars to his scanty hoard. I judged that his disposition was a good indicator as to his success as a salesman.

This little event kept indicators in my mind, and one day when I chanced to come across an old-style diaphragm steam gage I saw that I had something that could be very readily made into something else and save me some work.

There is nothing more pleasing to a mechanic than to be able to demonstrate beyond question something that he believes from reasoning but which he cannot make others see as he does. When Johnnie was turning that nice true shaft and I told him it wasn't *exactly* round he rather doubted it. When I told him it was likely worse after he filed it he laughed very skeptically.

"Just put your hand on there now, will you, and see if it isn't round; you can't feel a thing." And I couldn't and said so.

"Then how do you make out it isn't round, I'd like to know?"

"By logic, Johnnie; by logic. Of course you know that a very heavy cut on a shaft will spring it badly if the shaft is long and not too big." "Yes." "Well, then, a lighter cut won't spring it so much, and the lighter the cut the less the springing, until by and by the springing is less than we can measure or detect, but still we know it must be sprung some, *because*, if a very, very light cut didn't spring it *any*, a heavier one wouldn't either, and so, following the matter up, the heaviest kind of a cut would not spring it any either."

Johnnie drew a long breath and looked slowly around the shop for something to follow the reasoning with. Over on the

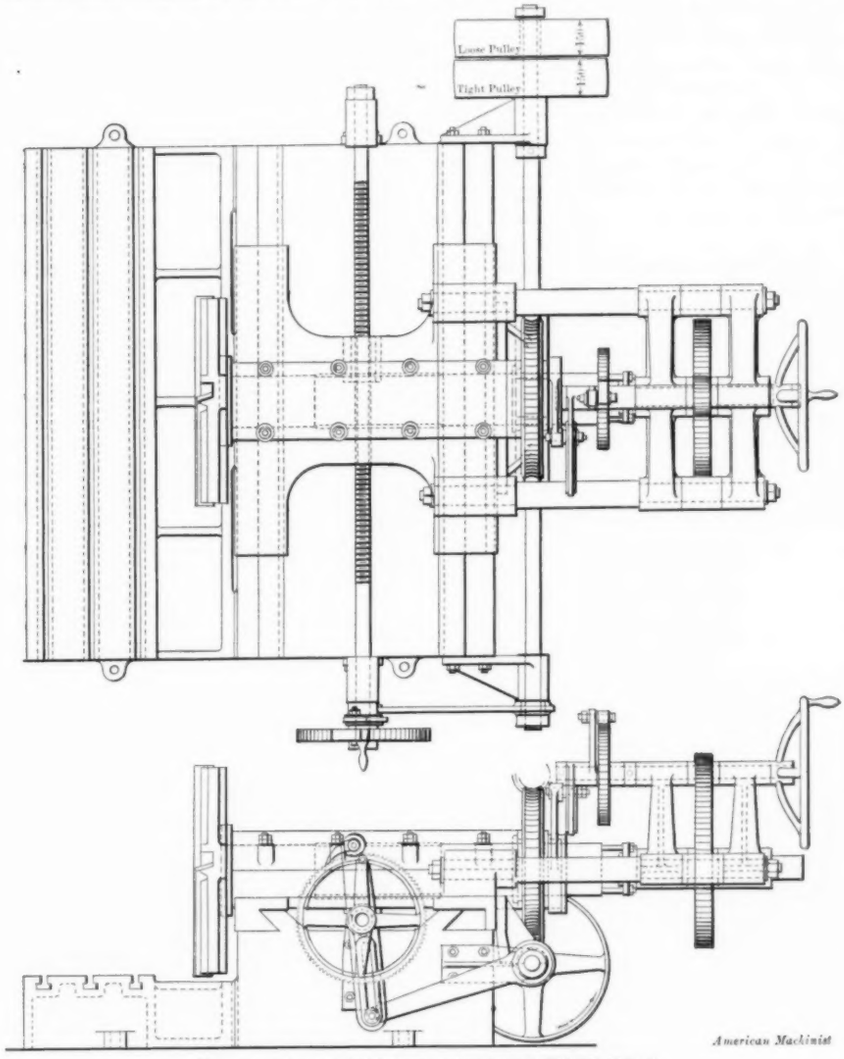


FIG. 3. FACING MACHINE WITH TRAVELING HEAD.

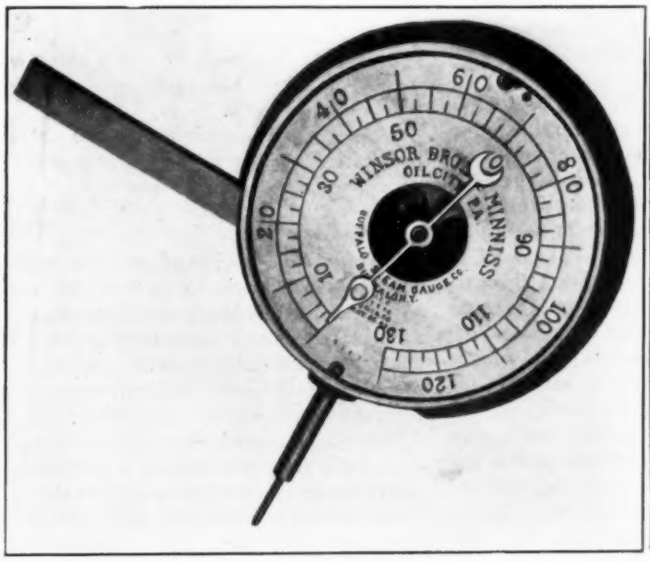


FIG. 1. FRONT OF HOME-MADE LATHE INDICATOR.

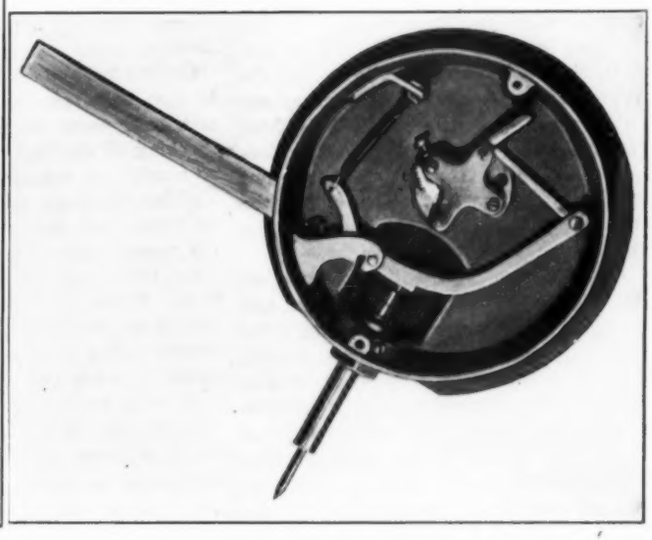


FIG. 2. INDICATOR WITH DIAL AND POINTER REMOVED.

big lathe a man was trying with the aid of a bar to get enough force on a piece of iron to make it stay sprung. As Johnnie's eye rested on the job he thought he saw his chance.

"There, now," said he, "you can see that piece spring when he pulls down on the end of that bar; according to your logic, as you call it, if a fly lit on the end of that bar it would spring it, too. Do you think it would?" And Johnnie looked at me with a very broad grin.

"Of course it would. If the fly lit on the shaft instead of on the end of the bar it would still spring it *a little*—even a mosquito or a gnat would. If one wouldn't, neither would two or three, or a hundred, or a million, or a pile as heavy as an elephant. You must not expect a fly to spring it *much*, though," said I.

"That may be all right in *theory*, but I guess it's no go in *practice*. That's some of the stuff the books tell you, but I don t believe it. If it's so, prove it. You just prove it and I'll believe it. You don't need to get a fly, even. I'll lay my hand on this shaft and you show me it springs. And Johnnie looked at me in triumph. Evidently he thought it was "up to" me.

"You would need to have your hand touch on both sides or the heat from it might spring the shaft out of true," said I.

"Then I suppose the heat of the fly's feet will spring it *a little*," came with quite a sarcastic emphasis from Johnnie, and showed me that nothing but an ocular demonstration would convince him, and as I was not prepared to give it I walked away.

When I began making my indicator I did not think I would get it fine enough to measure the deflection caused by a fly on a 4-inch shaft, 6 feet long, but I did want to get it as fine as good commercial work in our line demanded. The most important use I have for it is in connection with turning cranks. Owing to the shape of them, they are very liable to be sprung, even with the greatest of care. Where a bolt is used to keep the two wings of the crank from closing in from the push of the centers it must be just right, and that just right depends on the judgment of the man; neither written nor verbal orders will supply it. The depth of cut, feed and speed are all important factors, and while the indicator does not supply the judgment a bit more than the orders do, it does show how good the judgment has been.

This indicator was made by removing the diaphragm from the steam gage and putting in a sleeve with a sliding steel spindle whose inner end presses against the lever that is made to rest on the diaphragm, the outer end of the spindle touching the work to be tested. A piece of iron fastened to the case at right angles to the spindle serves to hold it in the toolpost of the lathe. Springs take up the slack. By using the means provided for adjustment the ratio of increase between the pointer and the spindle can be varied. No attempt has been made to make it give the variations in definite amounts, but, as I use it, one thousandth of an inch moves the hand nearly what 7 pounds steam variation should in the original gage, or a little more than ½ inch.

By its use it is very easy to show the relative resistance to springing that a crank possesses in different positions of the web. The fingers placed against the tool carriage while the thumb is pressed against the crank will show a marked variation in amount of spring at various points.

To demonstrate the fly-springing theory roughly I tried a 3¾-inch shaft (not a crank, but a plain, straight shaft), 52¾ inches long. With the indicator set in the center of the shaft, I could with a pull or push of one hand make a very distinct movement of the indicator hand without any bracing of the feet and with a steady pull or push.

A young man, who was watching with much interest, put his hands around the shaft and gave a jerk. The way the hand jumped would almost make one think he had bent the shaft. To see whether some of the spring was due to the yielding of the tailstock spindle, the indicator was placed near the end of the shaft when pulling and pushing on the tailstock spindle did not disturb the hand.

Thinking it might interest some, I have taken some measurements. The face of the gage is graduated to 130 pounds, and there is a space not graduated; .019 inch movement of the spindle will cause the hand to move from zero to 130; .0215 inch will cause the hand to make a complete circle. The hand is 1⅞ inches from center to point, so .001 inch will cause the hand to move .548 inch, nearly.

With the shank of the gage in the toolpost and with the spindle against the end of the spindle of the footstock on a 16-inch lathe, if the spindle is moved back and then locked, the hand does not deflect. If the spindle is moved forward and then locked, the locking deflects the hand about ⅛ inch.

On this lathe the footstock is held down by two bolts, one in front of the other and both about the center of the bed. Slacking off the back bolt moves the hand 20 pounds, = .003 inch; tightening it and slacking the front one gives a motion of 10 pounds, = .0013 inch, to the hand in the opposite direction. Locking the carriage moves the hand 15 pounds, = .002 inch. When the carriage is locked (the lock is on one corner at the back side) a strong pull or push with the hands on the apron does not deflect the hand.

A twist on the cross-slide shows very plainly, especially if applied above the compound rest, which showed a total deflection of 40 pounds, =.006 inch; this by first pulling one way and then the other and taking the extreme reading each way.

When a shaft has been finished as closely as possible to a snap gage and the indicator then run over it, the indicator is apt to show hills and valleys, and on a piece made from built-up scrap the movement would seem to indicate travel over a corduroy road.

While not at all delicate in the sense of being fragile, and while not being an instrument of precision in the way of giving definite readings, yet for the purpose of showing to the eye minute variations in an unmistakable manner, it has been very useful. Its range is about one and one-third turns of the hand, or 1-32 inch travel of the spindle.

The photographs will give a fair idea of its appearance and construction.

W. Osborne.

Law Points for the Workshop.

CAREFULLY COMPILED FROM THE LATEST DECISIONS OF THE HIGHEST COURTS.

After machinery has been repaired and the foreman has notified a workman that it is all right, the latter is not guilty of contributory negligence in continuing in the performance of his duties. (66 S. W. Rep. 268.)

A workman has the right to assume that his employer has done his full duty in furnishing reasonably safe machinery, and such workman is not chargeable with contributory negligence in using that which has been furnished him. (89 N. W. Rep. 322.)

Where an employer provides a place for his workmen to eat, or directs or permits them to go to a place for that purpose, he owes to them the same duties of protection from danger there that he does at the place where such employees work. (62 N. E. Rep. 853.)

The obligations of an employer, in a complicated business, where a large number of workmen are mutually engaged, to formulate and enforce a proper rule for their conduct, will not authorize a claim for damages to one of such workmen, who, with knowledge of repeated violations of such rule, continues thereafter in the employment, until injured by reason thereof, without notice by him to the employer of such violations. (88 N. W. Rep. 1003.)

A workman is bound to exercise ordinary care for his own safety, and he must notice dangers which are apparent; but he need not hunt for hidden perils. (97 Ill. App. Rep. 601.)

Whether an employer of men has exercised reasonable care to see that his employees worked amid surroundings as safe as with reasonable care they could be made, is a question of fact for the determination of the jury, under instructions from the court. (96 Ill. App. 288.)

The negligence of the employer is not one of the risks assumed by a workman, where the question of the negligence of a fellow-workman does not arise in the case. (62 N. E. 814.)

The doctrine that an employer must furnish his employee with a safe place in

which to work does not apply to a case where a workman is called on with knowledge to do work inherently hazardous, such as repairing defects. (89 N. W. Rep. 98.)

Where a workman is commanded, by one having the right to give him orders, to do an act obviously attended with danger, he has a right to assume that the employer has exercised reasonable care to make the act reasonably safe, and that it is not attended with hidden perils of which the employer had no notice. (97 Ill. App. Rep. 624.)

Where an employer has supplied his workman with suitable appliances, their ordinary use may be left to competent employees with no further attention from such employer. (51 Atl. Rep. 237.)

Where a workman, knowing the hazards of his occupation, as the business is conducted, is injured while engaged therein, he cannot maintain an action against his employer for an injury merely on the ground that there was a safer mode in which the business might have been performed, the adoption of which would have prevented the injury. (97 Ill. App. Rep. 145.)

Where there are obscure conditions in the machinery furnished, increasing the hazards, the employer should give ample warning and information to his workmen concerning the same. (89 N. W. Rep. 322.)

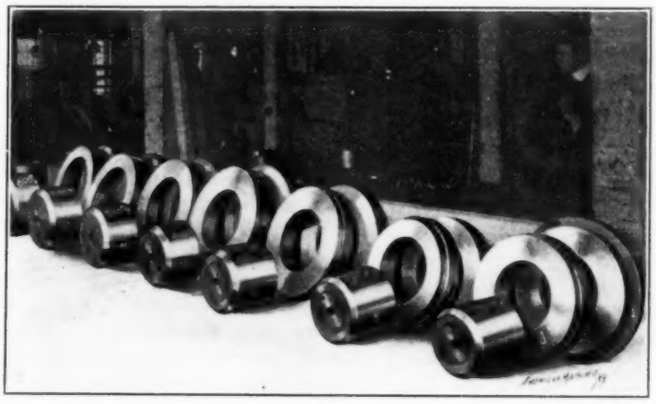


FIG. 1. DRAWING DIES FOR LARGE SHELLS.

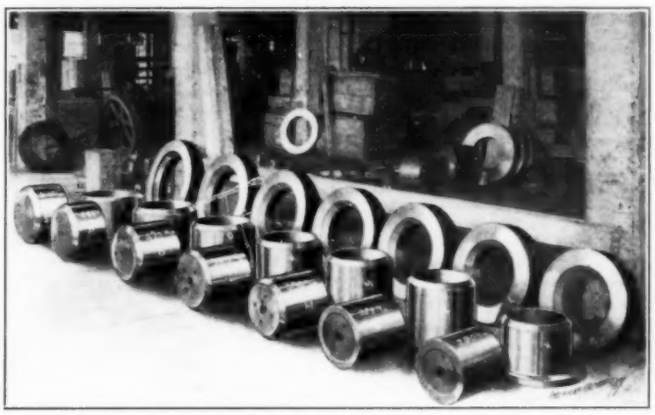


FIG. 2. DIES AND INSIDE BLANK HOLDERS FOR REDUCING LARGE SHELLS.

Large Drawing Dies for Circular Shells.

BY JOSEPH V. WOODWORTH.

The photographs, Figs. 1 and 2, show a collection of large drawing and redrawing dies for producing from flat blanks large circular shells. These dies were made in the shops of the E. W. Bliss Company, and formed part of an order of presses and dies for a sheet-metal goods concern in Europe. They were made to metrical dimensions, the diameters ranging from 290 to 600 millimeters, or say, from 11.4 to 23.6 inches, the largest set at the left and the smallest at the right. Each set consists of a drawing punch, a drawing die and a blank holder. Drawing dies of this type differ from those used for small work in that they draw the articles from blanks previously cut, instead of being provided with cutting edges which punch the blank at the same stroke. The outer edges of the drawing dies are turned to the same diameter as the blank to be drawn, and the operator locates the blank by simply laying it on the face of the die and locating the edges with his finger. Very often, however, shells of different hights are produced in the one die. This of course requires blanks of different sizes, and then to locate them true on the die face adjustable gages are used which can be attached to the die and removed at will. Dies of this type are made to produce large shells of any style or shape, and draw the article at one or more operations, according to the shape and depth to be obtained. In work of considerable taper, such as large flared pans of thin stock, two or more blanks may be drawn at the same stroke of the press.

Fig. 2 shows seven sets of redrawing dies with inside blank holders. The punches are shown in the front of each set and the dies at the back. Drawing dies with inside blank holders, as shown here, are used for redrawing shells which have been first drawn in dies having outside blank holders, like the dies shown in Fig. 1. The inside blank holder holds the partly finished article at its lower beveled edges between the beveled edge of the punch and the beveled seat in the die, while the punch draws it into a deeper shape of reduced diameter.

These drawing and redrawing dies are mostly made of a special grade of cast iron, treated in such a manner as to give a very dense and uniform texture to the metal at the working surfaces. To do very accurate work, however, steel rings are set into the dies, and the blank holders are made of steel castings, which adds considerably to the durability of the tools. For shells which have to be finished to very accurate diameters hard steel "sizing" punches and dies should be used after the last redrawing operation.

Increasing Foundry Production.*

Sometimes a foundry, while equipped with all the modern appliances for turning out work, finds itself unable to live up to its contracts. The following method was employed in one, which, though not modern in all its equipment, yet competes successfully with those that are. Being part of a large plant for the manufacture of light machinery, there came a time when the other departments were compelled to run night and day, with the natural result that the foundry, already taxed to its limit, was unable to keep up the work for the machine shop. Part of the work was therefore given to another foundry in order to help out. This was most unsatisfactory to every one, except the other foundry, and the manager adopted the same system, with modifications, as the machine shop, namely, two crews of molders, machine operators and laborers.

The day crew began work at 5.30 A. M. and worked till 5.30 P. M., with one hour for dinner, and were paid for twelve hours, while the night crew started at 5.30 P. M. and did not finish till 12.30 or 1 A. M., getting paid for eight hours. The crews changing about every week, payments were made every two weeks, their average time being ten hours daily. On Saturday

*From a paper by David Reid before the American Foundrymens Association.

the men started one-half hour earlier, to avoid Sunday work.

Previous to this arrangement, the men had been receiving three hours extra as a premium for additional work, while the two cupolas, one small remodeled McKensie and a large one of the same type, were supposed to be at their limit, giving in two heats 27 tons of a melt daily.

In the writer's opinion, the doubling of this amount of iron melted, which was accomplished and even exceeded at times, is the most creditable part of this method of increasing the production. The small cupola was used in the forenoon, being timed to drop bottom at 11.45, and bringing down a melt of twelve tons. Five hours later a laborer "chipped" it out, getting it ready for the melter and his assistant, who, after eating their supper, had this cupola ready for the blast at 9.30 P. M., when a second heat of seventeen tons or over was melted in the one cupola, making a total of twenty-nine to thirty tons every twenty-four hours from a cupola rated by the builders at four tons per hour. The main heat of the day was in the large cupola, which seldom went under twenty-seven tons, this being arranged to get through at 5.30 P. M., there being one section of the shop that worked ten hours straight.

This system of increasing production was carried on most successfully for a period of seven months, until business became normal again, and at the end of that time the foundry was nearly three months ahead of the machine shop, which is an exceedingly good thing to have during a time of labor agitations of various kinds.

As stated before, the cupolas used were of the McKensie type and the hight from bottom plate to bottom of charging door was only 9 feet. The daily consumption of fire brick used in patching was only eight on an average for the entire period of seven months, when the small cupola was re-lined to the charging door.

How about molding sand? you would ask, and my reply is that this was taken care of by pouring the front of every floor that was to be used at night, in the first or morning heat, and having laborers take out the castings and wet the sand. When the balance of the work was poured and dumped, that sand was placed at one side, leaving the cold sand ready to be used by the night crew.

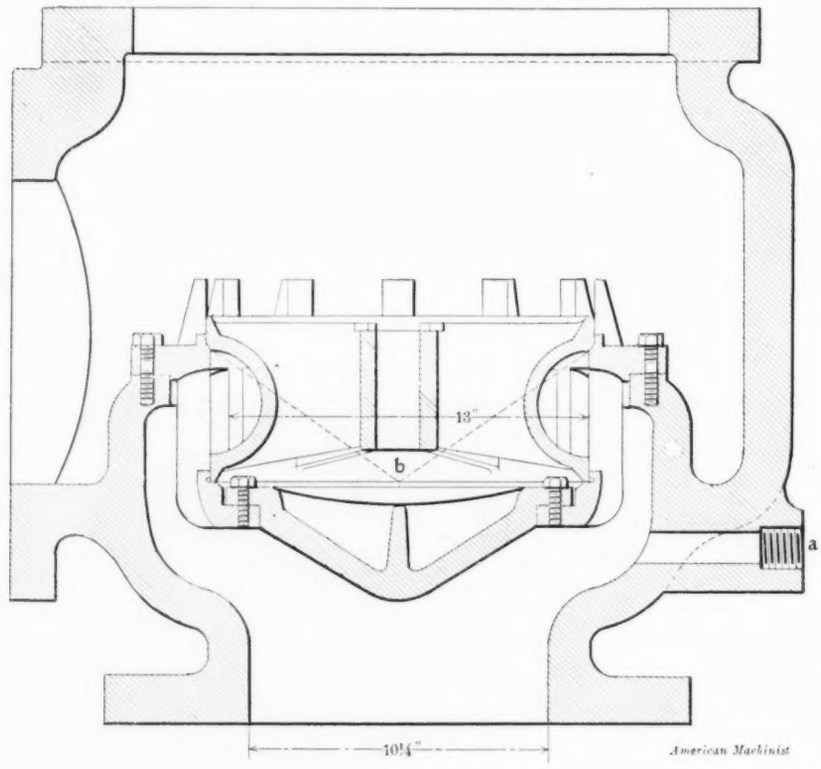


FIG. 1. THE VALVE.

In regard to the cost per pound of producing castings by this method, though not at liberty to give exact figures, I can assure you that it was less than for the six months preceding, when the men were receiving premiums.

In the recent conference of the Iron Molders' Union and the Stove Founders' National Defence Association, it was recognized by the molders that the general trend of industrial development is in employing skilled labor, as far as practicable, at skilled work. I am willing to predict that in the future, and how near for you individually, depends upon your managers to a great extent, that every molder without reference to the class or character of the work, will do nothing but produce, leaving the pouring, the dumping of work, the cutting and mixing of the sand and all other laboring work to unskilled labor. When you reach the point where the molder starts in the morning to practice the art at which he has served a number of years' apprenticeship, and continues at that work all the time he is being paid for, then, and not until then, will you have solved the problem of the greatest production at the lowest cost.

Ninety-five per cent. of the molders in jobbing and general machinery foundries stop when the blast goes on, whether it gives them six or seven hours of molding time, and, as all cannot pour first, the greater part of the crew are waiting their turn and doing nothing.

What matters it if you insist on their staying in the foundry till the whistle blows, do you gain anything by it, except the moral effect it has on the other departments, which of course is no small matter?

You might ask how the molder would take to this system, and though they appreciate the efforts in this line, in the stove foundries, where it is all piece-work, yet in machinery work, might it not cause trouble? Having a large number of molders working under this division of labor principle, I can say that they are perfectly satisfied and think it the finest scheme yet devised, as they have no pouring or dumping to do, thus eliminating the hardest and hottest part of wha formerly constituted their work.

The only objection that comes from anyone is in regard to the pouring crew. But obstacles are encountered only to be overcome by the ambitious, and the men who do the pouring may be only laborers under the direction of a molder, trained for that special work as you would train them for the molding machine. Or, if you prefer it, they can be culled from your apprentices with the addition of a molder or two as leading hands, while a large majority of your molders keep the cost where it belongs by producing molds.

The dumping and cutting over the sand in the machinery shop where this system is in vogue, is accomplished by means of a night crew of laborers, fifteen in number, who take care of the work of 120 men in twelve hours.

That the pouring requires a certain amount of skill is granted, for on that often depends the quality of the work, yet we have an instance right here in old New England, where laborers, trained of course, pour the entire amount of work put up by the molders in a foundry handling nearly 2,500 different patterns in a week, the weight in the casting varying from an ounce to 275 pounds.

The immediate result of this method of increasing the production was the saving of one day's wage all around, as the same amount and over, in fact, was produced in five days, where before with the same crew it took six.

A Large Differential Action Reducing Valve.

The accompanying illustrations show a reducing valve of unusual size in which the "differential" or "floating" lever principle, which first made its appearance in the Sickels steam steering gear for steamships, but which has since found a wide variety of applications. Many of these applications are to mine hoisting machinery and the valve shown was in fact made for a copper mine in Northern Michigan. In whatever form the principle appears or to whatever use it is applied, its object is to enable a comparatively small initial effort to direct and control a much larger resistance. In the cast of a steam steering gear a small pilot wheel directs the action of a steering engine which turns the rudder, and in the present case the small effort due to the slight permissible variation of steam pressure on the reduced pressure side of a reducing valve, acting on a small, delicately made piston, is made to control the movements of a much larger piston which in turn opens or closes the reducing valve as may be required. The small piston is thus relieved of the labor of moving the reducing valve, which, in this case, is so large as to make it doubtful if it could be satisfactorily controlled by the direct action of the fluctuating pressure on the lower side of the reducing valve.

In the accompanying illustrations, Fig. 1 illustrates the valve proper, which will be seen to be intended for a 10-inch pipe, the actual valve being 13 inches in diameter. The valve is of the double-beat Cornish type, and of one elegant feature of it we shall have more to say later. The controlling apparatus is shown in Fig. 2. A pipe conection is provided at *a*, Fig. 1, on the reduced-pressure side of the main valve, which is connected by a pipe with the corresponding pipe boss *b*, Fig. 2. In the latter figure, *c* is the initial piston, which is also a valve and which has a hole *d* connecting with the annular space *e*. Spaces *e* and *f* are thus subjected to the reduced pressure below the main valve of Fig. 1. Full boiler pressure is admitted to the space *g* through the pipe boss *h*. A moving valve seat *i* surrounds the initial piston *c* and suitable ports lead to the cylinder of the main actuating piston *j*, which is connected directly to the main valve of Fig. 1 and above which is the oil filled dash pot *k*, the office of which is to prevent sudden movements of the parts. The initial piston *c* is loaded by the weights *l* through the lever *m*, a second dash pot *n* preventing sudden movements of the weights. The actuating piston *j* is connected by lever *o* to the moving valve seat *i*.

Assuming that the parts have been in equilibrium but that an increased demand for steam has initially slightly reduced the pressure below the main valve of Fig. 1, the first result is a corresponding reduction of pressure in space *f* and under the weight *l* the initial piston *c* falls. Steam is at once admitted from space *g* to the lower side of the actuating piston, causing it to rise and open the main valve. This opening must not, however, go on indefinitely, but must be determinate in amount depending on the initial reduction in pressure, and this is accomplished by the connection of the actuating piston to the annular valve seat *i*. The rise of the actuating piston obviously depresses this valve seat which, by thus following the motion of the initial piston, closes the port which the movement of the piston opened, and the greater the movement of the initial piston the greater must be the movement of the actuating piston and main valve before it causes the valve seat to overtake the initial piston. A decreased demand for steam and a consequent rise in pressure below the main valve would act contrariwise and close the main valve, the exhausting of the steam from the advancing side of the actuating piston being to the reduced pressure space *e* or *f*, as the case may be.

It still remains to describe the office of the spring *p*. Assuming a drop in pressure in space *f*, the initial piston, were there no spring *p*, would drop indefinitely, regardless of the amount of drop in pressure. As the piston is loaded with a weight, any reduction in the pressure below that due to the weight would cause the weight to preponderate and depress the piston indefinitely. This action would be restrained, as regards its rapidity, by the dash pot *n*, but the descent of the initial piston would nevertheless continue until overtaken by the valve seat, regardless of the amount of the reduction of pressure, instead of sinking promptly by an amount determined by the reduction in pressure

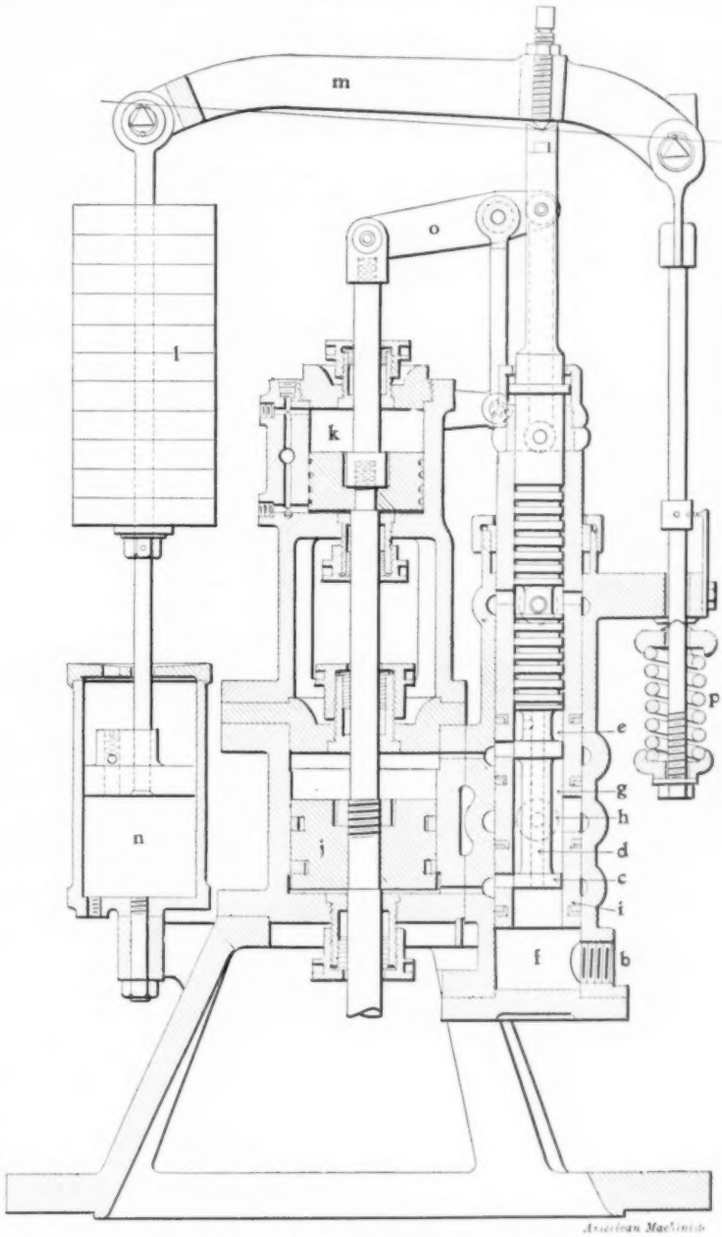


FIG. 2. THE CONTROLLING MECHANISM.

and stopping there, as it should. The action may be compared with that of an isochronous or unstable centrifugal governor. Were the dash pot *n* and spring *p* both absent the action would be exactly analogous to such a governor, the valve constantly "hunting" for its position, but never finding it. The addition of the dash pot without the spring would be analogous to that of such a governor with a corresponding dash pot—the action would be delayed but would be otherwise unchanged. The addition of the spring is equivalent to a change in the governor whereby it is made stable but momentarily relieved of the action of the dash pot. What is desired is an instantaneous sinking of the initial piston to a greater or less extent corresponding to the greater or less drop in pressure, and this is secured by the action of the spring. When the pressure below the initial piston drops, the piston sinks. The weight *l* is momentarily carried by the dash pot, and the spring *p*, being relieved of load, extends itself instantly and follows up the movement of the initial piston, maintaining a load upon it, but a load that is progressively lessened, and the piston thus promptly sinks until the reduced pressure balances the reduced load. The sinking of the weight and the opening of the main valve then go on together, the pressure below the main valve and the initial piston rising together. Under the combined action the spring is recompressed and equilibrium is finally reestablished when the original pressure is reached. In other words, the action is static as regards quick changes of pressure, but astatic as regards permanent changes, the permanent pressure below the main valve being the same, regardless of the consumption of steam, but there being a momentary fluctuation of pressure as the rate of consumption changes. The final action is equivalent to a governor which should give a constant speed for all loads, but which should give a slight momentary change of speed with each change of load.

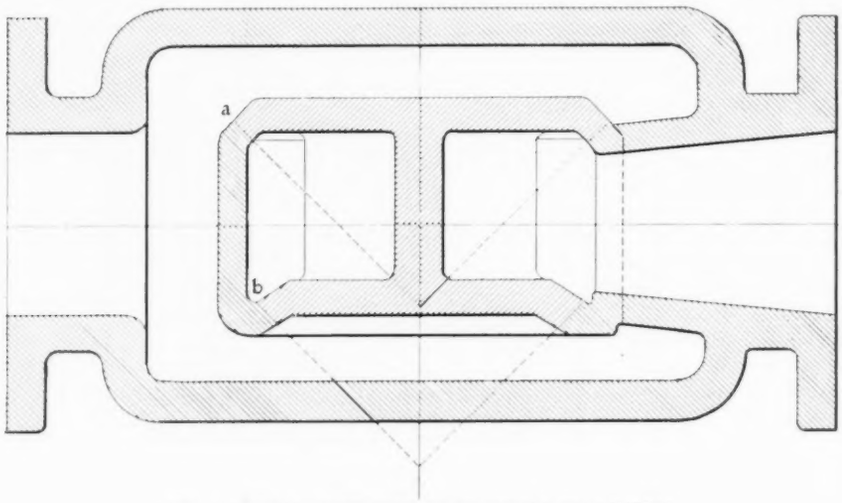


FIG. 3. USUAL CONSTRUCTION OF DOUBLE BEAT VALVES.

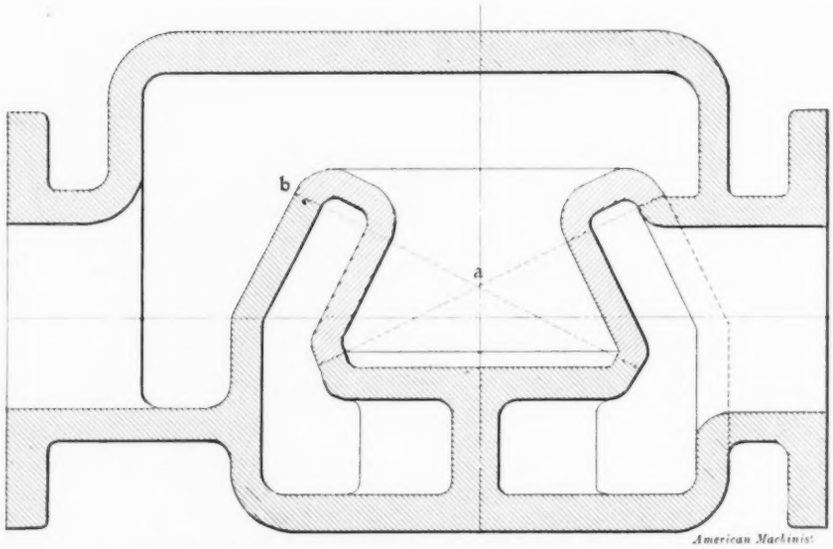


FIG. 4. MODIFIED CONSTRUCTION OF DOUBLE BEAT VALVE.

Going back now to the main valve, Fig. 1, it is well known that valves of this type are difficult to keep tight. Slight differences in the coefficient of expansion of the metals composing the valve and its case, or slight differences of temperature due to the accumulation of water will cause one or other seat to lift slightly and thus leak. A basic principle of construction is incorporated in this valve, which appears to be of general application.

Fig. 3 is a sketch showing the usual construction of these valves, from which it will be apparent that any difference of expansion between valve and case will open one or other seat. Should the valve expand, the more the seat *a* will open; while should the case expand, the more seat *b* will open. Fig. 4 shows a different construction, the essential feature of which is that the cone surfaces of the two seats have a common apex at *a*. Should the valve expand, the more its vertical expansion will tend to open the seat *b;* but its horizontal expansion, having the same increment of excess, will tend to close the seat, and the two actions will offset one another. The reverse action will take place should the case expand the more. Looked at in another way, the expansion of both valve and case is from the common center *a* and any difference of expansion is accompanied by a slight sliding of valve and seat upon one another on the line of the joints between them, but without any tendency to open either joint.

This action will take place wherever the common apex *a* may be and regardless of the order of the two seats. In the valve shown in Fig. 1 the lower seat is flat, but the two seats intersect at *b*, and the action described in connection with Fig. 4 still holds.

The valve is the product of the Nordberg Manufacturing Company, of Milwaukee, Wis., to whom we are indebted for the prints from which the engravings have been made.

How the New Things Help the Old.

Suppose that the wireless system of telegraphy enables us to transmit signals across the Atlantic in a satisfactory way, what of it? Is that going to affect the condition of the present cable companies? It may at first, perhaps, if the Marconi system proves to be just as good a system and even a better one than the present cable systems. But it will affect them in the same way that electric lighting affected the gas companies. Gas stock went down at first. To-day it is way up. How did the telephone affect telegraphy? Why, telegraphy stands higher to-day than it did in 1876. Do you suppose the perfection of bicycles and automobiles has affected the price of horses? Why, last spring the prices of horses were higher than at any other time in the history of this country. I myself sold a horse last spring to a dealer for more than I paid for it several years ago.—*Prof. Pupin at the Marconi dinner of the American Institute of Electrical Engineers.*

Drawing the Temper.

BY E. R. MARKHAM.

Unfortunately the words "temper" and "tempering" have entirely different meanings according to different authorities. To temper, as defined by Webster (metal), is "to bring to a proper degree of hardness; as, to temper iron or steel."

The word tempering, according to the same authority, as relates to metal, is: "The process of giving the requisite degree of hardness or softness to a substance, as iron and steel; especially the process of giving to steel the degree of hardness required for various purposes, consisting usually in first plunging the article, when heated to redness, in cold water or other liquid, to give an excess of hardness, and then reheating it gradually until the hardness is reduced or drawn down to the degree required, as indicated by the color produced on a polished portion or by the burning of oil."

The generally accepted meaning of the term "to temper" is, the double process of hardening and drawing the temper.

According to Metcalf, in the glossary of his book, "Steel," the word temper is defined as: "Used by the steel-maker, it means the quantity of carbon present. It is low temper, medium or high, or number so and so by his shop numbers. Used by the steel user or the temperer, it means the color to which hardened steel is drawn —straw, brown, pigeon wing, blue, etc., etc. Or it is the steel-maker's measure of initial hardness, and it is the steel user's measure of final hardness."

Then again, at page 116 of this excellent work, he says, "After a piece of steel is hardened it is usually tempered to relieve it of the strain, reduce brittleness and increase toughness."

At page 118 of the same work: "This is the unfortunate second use of the word temper, which must be borne in mind if confusion is to be avoided in consulting with steel makers and steel workers. The meanings may be tabulated thus:

Temper.	Steel Makers' Meaning.	Steel Workers' Meaning.
Very high.	150 Carbon	Light straw.
High.	100 to 120 C.	Straw.
Medium.	70 to 80 C.	Brown to pigeon wing.
Mild.	40 to 60 C.	Light blue.
Low.	20 to 30 C.	Dark blue.
Soft or dead soft.	Under 20 C	Black.

According to my experience, hardeners seldom confound the two operations of hardening and drawing the temper; they speak of hardening a piece of steel, and of tempering or drawing the temper. The temper is drawn from a piece of steel made into a cutting tool, not because it is necessarily too hard, but because it is too *brittle*. The operation of toughening, or of drawing the temper, necessarily softens it somewhat. Generally speaking, it would answer the purpose better if the tool could be left *dead hard*, and yet contain the necessary quality of toughness.

Many tools are too brittle if left as they come from the hardening bath, which do not have the necessary hardness if drawn to a straw color; and yet a faint straw is the first color visible to the eye. A little consideration will convince one that the range of heat from a tool stone cold to 430 degrees—which is the amount of heat a piece of steel must be raised to in order that a light straw color will show—is very great. A full straw color is 460 degrees, a range of only 30 degrees, and yet the difference in the hardness of pieces drawn to each is very noticeable.

I have in mind a forming tool for automatic screw machine work which, when hardened and not drawn at all, was too brittle to stand well, and when drawn to a straw color—even the faintest—it would not stand as well as we thought it should; yet when hardened and drawn to only 220 degrees it did excellent work.

In looking over one of my old record books I came across records of a number of articles that were to be drawn to various degrees of heat in tempering. One was to be drawn to 300 degrees, one 375 degrees, while the forming tool mentioned was to be placed, after hardening, in a kettle of boiling water, which gave it the necessary toughness. The boiling water was used, as we always kept a receptacle for it, to drop pieces in after hardening, to prevent cracking, as explained in a former article.

Many times tools have to be drawn much lower than is best, because they are given too much heat when hardening. This leaves the grain open, and the steel very brittle, necessitating a lower temper than would be the case were the piece properly heated for hardening.

Many blacksmiths do not understand—or are careless—heating and hammering steel when forging tools, in order that it may be tough. I have known a tool forger who would forge a diamond point lathe tool and harden it without drawing the temper, while another smith would forge a similar tool from the same bar, and, after hardening, it would be found necessary to draw the temper to a straw color in order to have it stand. The tool which was *not drawn* would stand a great deal more grief and do much more work than the other.

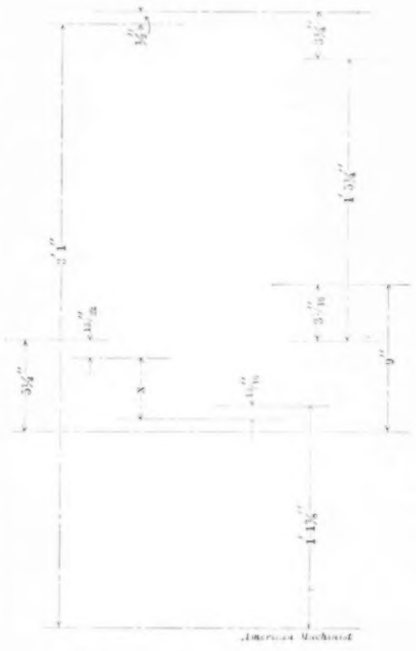
If mechanics realized the effect of *too much heat* on tool steel, many of them would be much more careful when heating for forging, annealing or hardening. A *high* heat has the effect of separating the particles that go to make up the piece of steel. When the particles become separated, or the piece disintegrated, the steel when fractured has a coarse, fiery appearance. Such steel, unless burned, may be restored, so far as appearance goes, by reheating to a *low* red, but is not as reliable as before.

Steel that has been overheated has to be drawn to a lower temper than would be the case had it been properly treated; consequently, the loss to the manufacturer or the job workman is very apparent, when we consider that the tool will not stand as high a rate of speed or as coarse a feed, and that neither will it run as long between grindings.

How to Find the Unknown Figure on Drawings.

BY FRANK B. KLEINHANS.

The illustration herewith represents a nest of figures such as one often strikes on drawings. It will be seen that the dimensions are given at all places except that shown at x, which we will suppose is a very important dimension, as for instance the distance from one planed surface to another. The scheme is to start at one extremity of x and go up or down, and note the dimensions, one after the other, in two columns, placing all the dimensions going up in the + column and all those going down in the — column.



HOW TO FIND THE UNKNOWN FIGURE.

The difference between the + and the — columns will be equal to x.

We will begin with the lower extremity of x and go up; by taking one figure after the other, we have: $+x$, $+ \frac{13}{32}$, $- 5\frac{1}{2}$, $+ 9$, $- 3\frac{7}{16}$, and so on as arranged in the following columns:

—	+
	x
$5\frac{1}{2}$	$\frac{13}{32}$
$3\frac{7}{16}$	9
$\frac{1}{2}$	$1' - 5\frac{1}{4}$
$3' - 1$	$3\frac{1}{4}$
$\frac{13}{16}$	$1' - 1\frac{3}{16}$
$3' - 11\frac{1}{4}''$	$3' - 7\frac{29}{32}''$
$3' - 7\frac{29}{32}''$	

Hence $x = 3\frac{11}{32}$

When the dimensions run horizontally, the method is the same. The + sign rep-

resents dimensions going to the right and the — sign those to the left.

This little method will save a wonderful amount of time and energy, not only for the machinist, but for the draftsman and the engineer as well.

Our Foreign Trade Methods.

I have read with much interest the letters of your special correspondent now traveling about Europe, and endorse thoroughly his remark, "As everybody knows who has looked into the matter, we are especially weak in our foreign sales department."

I have spent some eighteen years selling American-made goods abroad, and yet have never been able to satisfactorily account for this strange fact. Hundreds of sharp, shrewd, level-headed business houses who are known from San Francisco to Portland, Me., for the ability and success with which they conduct their home trade, fail utterly when they make an attempt at foreign business. Their treatment of probable customers at home is on the broadest and most liberal basis, while the moment they are brought in contact with a foreigner they assume a position which can best be expressed by the word provincial. Invoices in United States currency and delivery f. o. b. New York, with, in many cases, provision of cash against b. l., are the only terms that they care to offer. After these terms, which in themselves prevent the possibility of a large turnover, are accepted there often follows an utter disregard of the packing, triplicate invoicing and proper manifesting of the shipment requirements of the purchaser; the prevailing opinion in many establishments being that what is good enough for the United States in these respects is quite good enough for a "Dutchman" or a "dago."

One cannot help feeling that a look at the transaction from the foreigner's standpoint would show our friends how unbusinesslike their actions are and lead to their correcting their methods.

Auburn, N. Y. ROLAND R. DENNIS.

Letters From Practical Men.

Altering Old Patterns Not Always Profitable.

Editor American Machinist:

In a shop doing a large and varied line of work, some of it of a character which may never be called for a second time, the temptation to adapt old patterns to new uses is a very great one, and it requires a great deal of judgment and some philosophy to yield to it only at the proper times, and to firmly resist it at all others. Sometimes it pays to alter an old pattern for a new job; but, on the other hand, this is often done under circumstances that render it one of the worst varieties of false economy. The pattern is always more or less injured, and labor must always be expended in restoring it to its original shape in case it is required to repeat the job for which it was made. Except with a very excellent system of pattern keeping and storage, much time is often lost looking for patterns which have been so built up and altered for other uses as to be utterly unrecognizable. I have repeatedly seen men lay aside the very thing they were in search of because it had been so changed as to bear no resemblance to its original form. This means an expense in the pattern shop which should be set off against the cost of making a new pattern, and it is often coupled with extra cost in the drawing-room due to the endeavor to design other parts so to render the old pattern available without too much changing. Again, the patern used is often required to be built up on one part and stopped off on another. This means a larger flask than would have been necessary with a proper pattern and more time spent in ramming up superfluous sand, filling up and patching the mold, to say nothing of the time the molder spends scratching his head and trying to assure himself that he understands the thing aright, or that spent in conference with the patternmaker in obtaining a further explanation of the meaning of some of the stop-off marks. Where forming pieces are furnished by the patternmaker to be held in the mold while filling up the stopped-off portions, directions for their use are very often required, and this takes the time of both the patternmaker and the molder. As a means of avoiding some of these difficulties the method of stopping off by means of cores is resorted to. When this is done core prints must be added to the pattern, core boxes must be made and this, with the coremaker's time and the cost of his materials, very much reduces the advantage gained by using the old pattern. Following the work into the machine shop, in many cases the pattern cannot be made exactly right, and we must depend upon the machinist finishing the casting to size. The core-box for a cylinder is a trifle too small, but the machinist can, of course, bore the casting out all right, if we only give him time enough. The same is true of the pattern for the plunger; if it be somewhat too large there is nothing to prevent the casting being turned down, except the cost of doing it. In this connection, however, it is not wise to lose sight of the fact that the machinist operating a large tool, using cutters that are furnished and ground at the expense of the establishment, represents a daily cost several times that of the patternmaker working at a cheap wooden bench and wearing out tools which he pays for himself, for the most part. Sometimes the original job required finish which might be entirely dispensed with in the case for which the old pattern is next used, but the finish has been allowed on the pattern and must be removed from the casting if the latter is required to be brought to size. When contemplating such a proceeding as this, moreover, it is well to remember that steel castings cost more to machine than do iron ones. This consideration will often determine that it is cheaper to make the pattern to size rather than to reduce the casting in the machine shop. In dealing with an expensive metal, such as phosphor bronze, the difference between what is paid for new castings and what is received for chips must also be taken into account.

In what has been said above, no notice has been taken of what is sometimes a most important consideration, and this is that the cost of the pattern occurs only once, while all of the other costs attach to every piece which may be made from it. A case which comes under my own observation is that of a cylinder pattern somewhat too large for the purpose for which it was used. A new stuffing-box head was made for it to suit the size of plunger required, and the large dimensions of the cylinder did no harm except that it cost more for metal, more for molding, more for machine work, more for bolts to bolt the head on, more even for painting it. As this pattern has been used repeatedly, these added costs would have paid for a new one several times over.

It is well to save the price of a pattern when it can be done readily, but to save fifty dolars in the pattern shop at a cost of $100 elsewhere is poor policy. When in control of the designing, it is well to keep within the lines of standard patterns as much as can be done conveniently, but it seldom pays to take a pattern which is in active service and devote it to another purpose. If the pattern is likely to be called for in its original shape, it will generally pay better to make a new one rather than to build up, or, still worse, cut down the old one.

In the case of patterns which are to be used very frequently, the cost of keeping them must be given its share of consideration, and it sometimes proves advisable to make a full set for a given tool and keep them together, even though some of them are duplicates of existing patterns which are used for other purposes. There is then no excuse for delay in starting work upon such a job. As soon as the order is received, the patterns are ready to be put in the sand, and the time which would otherwise be spent in assembling them may be devoted to something else. In many establishments the time which is spent in looking for things is a large factor on the cost side of their accounts, and the efforts to stop this leak may prove to be as well directed as others which at first seem of more importance.

GERALD E. FLANAGAN.

Local Case Hardening Again.

Editor American Machinist:

Mix some clay good and stiff and squeeze it on the part of the work you want to remain soft; case-harden in the regular way. The clay will prevent the

carbon from acting, and the work will be soft underneath it. This is the way some gun factories harden gun receivers.

J. E. B.

Obscure Time Tickets—The Premium Plan Where One Man Operates Two Machines.

Editor American Machinist:

I am much interested in anything you print on the premium plan. At page 906 you printed figures from the "Blank, Blank Engineering Works," showing the increase and gain due to this plan. You said also that in some shops a difficulty had been found because of the meaning of the time tickets being obscure. It seems to me that the solution described in the above named article gives the workman too much clerical work. I found the same difficulty in starting the premium plan, and so took an idea from the article by Mr. Rowan, published at page 49. He numbered each job. I number each piece, and subdivide each piece into various jobs, A, B, C, D, etc., to make a complete whole. This idea is plainly shown in the blueprint enclosed.

The blueprint is virtually an instruction sheet. The workman puts down A, B, C or D on his day time slip, according to the work he has done—for instance, 3021 C—and thus the office has no doubt as to the job he was working on.

I also have record cards arranged in a card file which give the history of the jobs. This is also taken from Mr. Rowan's article.

You may be interested to note that the workman can take the proper number of revolutions of his machine from the instruction sheet. I have the speed of each step of the driving cone painted on the machine, so there is no excuse for his not running his machine to the nearest speed given on the print instruction sheet.

I have just started premium plan, for I have been in business only a few months. Perhaps your readers can help me on one point. How is the premium plan operated when a man is running sometimes one and sometimes two machines? For instance, I have some jobs on the milling machine, such that a man can easily run two machines and produce nearly maximum capacity of each machine, while in other cases he will not get three-quarters of the capacity when running two machines, though he would get the full capacity if he ran one machine. If he runs one machine he can make a premium, but if he runs two he cannot make the full capacity, as stated above, and therefore he cannot make a premium, if it is figured on output of machine per hour. It would be almost impossible to give him the same jobs on two machines on premium every time.

I have not arrived at any conclusion in regard to such cases, and would like to hear from someone who runs the premium plan with men operating two machines on a variety of work.

CLINTON ALVORD.

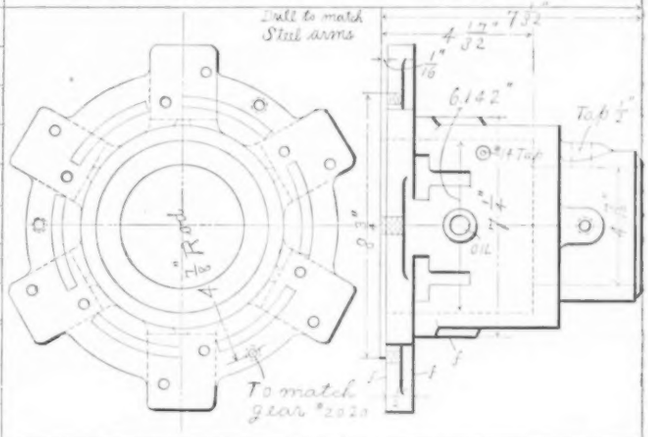
Draftsmen and Drawings.

Editor American Machinist:

There is no department of an engineering concern, whether large or small, where more care is needed, where mistakes are more easily made, and where when made they are harder to rectify than in the drawing room; it is here that most of the ideas to facilitate the construction or operation of a machine are thought out, and therefore it is the hight of folly to "rush" the draftsman, as "Cosmopolitan" recommends at page 580. I think that he must never have worked in a drawing room or he would not have penned those remarks; his plan may be all right and perhaps necessary in the case of tracers, etc., whose work is all straightforward, but to attempt to speed up a draftsman in the same man-

Operations	Holder	Tool	Feed	Rev. P.M.
A	Potter & Johnston Lathe			
Sq. up large end	Chuck	Armstrong	Medium	56
Rough face outside	"	"	"	29
Bore for 4 7/16"		2½" bar	"	18
Ream " "		" "	"	18
Bore for 6.142"		" "	"	18
Ream " "		" "	"	18
B	Engine Lathe			
turn up 8¾" for gear *2121	Arbor and Plug	Blue Chip	1/32"	20
Sq. up feet	"	"	1/32"	20
Sq. up hub	"	"	1/32"	56
C	Milling Machine			
Mill feet	Arbor fdg	1" End Mill		230
D	Upright Drill			
Drill for ½" tap (2)		25/64 Twist		320
" " 14 tap (1)		3/16" Twist	Hand	790
" " Oil (1)		3/16 Twist	"	790
Counter sink 3/16" (2)		Counter sink	"	500
Drill for rivets (12)		5/16 Twist	"	650

Metal Cast Iron Piece No. 3021



Operations	Holder	Tool	Feed	Rev. P.M.
E	Hand Taping			
½" U.S.S. (2)				
"14 U.S.S. (1)				

American Machinist

INFORMATION SHEET.

ner as a machine using the new tool steel would, in my opinion, result in a good harvest of mistakes which might cost far more than the amount saved through the increased output of the draftsman.

If I may again use the new tool steel as an illustration, I would remind "Cosmopolitan" that it is only on comparatively rough work that the great reductions of time can be accomplished. The more delicate operations where finish and accuracy are required have to be done at a much slower rate, and I think nobody will deny that the draftsman's work is above all others delicate. The careful study, the intense concentration of thought, and the innumerable points to be watched when designing a machine make it absolutely impossible for him to hurry and at the same time do his work efficiently.

I do not think that the sweeping reductions in time which "Cosmopolitan" seems to think possible will be brought about yet awhile, although at the same time I think that shorter ways of working will be found and improved appliances be invented, such as the universal drafting machine described at page 689 of the present volume, by which the actual drawing out may be facilitated, but until a speed-varying device is invented that can be applied to the human brain, we poor draftsmen will have to put up with all the abuse that is piled upon us, and I for one shall still continue to draw my much-too-large salary without any qualms of conscience.

I hope to see still more in the AMERICAN MACHINIST about drawings, and I wish that we could have the opinions of a few shopmen on the subject. DRAFT.

England.

The First Foundry and the First Casting in America.

Editor American Machinist:

The members of the Leonard Family Association appreciate your kind notice at page 1060 of the proposed monument to be erected in Taunton, Mass., of which Mr. Charles Henry Niehaus has just completed the model.

Your suggestion that the date given in our little pamphlet does not correspond with statements made concerning a certain iron kettle is subject to an explanation. It is not claimed that James and Henry Leonard made the first casting. It is doubtless correct that the iron pot was made in 1642, but the early efforts were absolute failures. What is claimed for the Leonards is that they were the first successful ironmasters of America. For eight or ten years previous to the building of the bloomery in Taunton a casting was made here and there. They had to do with many of these efforts. But that the iron business was put on a successful commercial basis at Taunton, Mass., by the two men whose memory it is proposed to honor is freely admitted by all who have carefully examined the earlier records of this industry. LEWIS A. LEONARD.

Keeping the Shop Clear.

Editor American Machinist:

I have already had my little say about the now current topic, "How to brace up a shop," but there are many things to be thought of in connection with it, and some of them can perhaps best be considered separately and under other titles.

Saying nothing at all now about what the men may do or what their habits may be, and considering only the foreman and whatever of authority and direction may be above him, speaking as a foreman of some years of not unsuccessful experience, I would say that one of the very important things in running a shop is to keep it always as clear as possible of everything that *at the time* does not belong there. This is a matter which is perhaps more generally disregarded than any other thing of equal importance. Shops usually are not too big at the best for what has to be done in them, and we all know that it is quite desirable to secure perfect freedom of movement for every workman in all his work and to have every tool perfectly accessible at every part where any operation is to be performed upon it, yet in too many shops we can see a state of affairs permanently existing which completely ignores these imperative conditions. The shop in which is to be found every necessary machine tool properly placed and lighted and every usable accessory and convenience, with all material upon which operations are in progress and that which is to immediately succeed it ready at hand, without having also much more not included in this brief enumeration, is the exception rather than the rule.

There are usually three classes of impedimenta in the machine shop, and only the wise and brave and determined, and also the most successful, shop conductors are able to banish them. That word "impedimenta" is a good word to employ in this case. The things here spoken of are impediments or hindrances and they should be so spoken of and thought of. The first class, and usually the least prevalent and least detrimental, consists of the work that is entirely finished. This of course is sure to be eventually removed, but it is not always done with sufficient promptness. Machines stand around very much in the way for the convenience of the painter first, and then of the shipper, and for the inconvenience of the shop in general. It is often thought that it is a matter of economy to make only one move of the machine after completion, when it would be much better to make two or three. The first move, to get it out of the way of the shop workers, should not be delayed at all, however the machine might linger elsewhere. The store-room is made to be crowded, the workshop decidedly is not. If the product of the shop consists of smaller articles these as fast as completed are often piled up on the benches and in convenient corners until sufficient numbers are accumulated for packing and shipping. They should accumulate somewhere else than in the shop, and should never in the least interfere with the movements of the workman, with the accustomed placing of his handy tools, or with the light which is so constantly necessary.

A second class of impedimenta is in many establishments a much more prevalent and serious one. This is the material to be worked on which is brought into the shop before it is possible to do anything with it. Some think it shows push and enterprise to rush in and pile up castings, and forgings and other raw material that can't be touched for a considerable time. It stimulates the workman, you know, to show him there is no danger of his working himself out of a job. It is well of course for a man to know that he is not on the last piece there is for him to do; but beyond having something ahead for the next hour or the next day a great accumulation in advance is apt to operate as a discouragement rather than a stimulant. I am speaking, however, rather of the material which is actually more or less in the way and which interferes with freedom of movement, with light and cleanliness. I have in mind my actual experience in this line. I was for eight years foreman of a shop which was practically always busy. We were building by contract a line of machinery embracing twenty or thirty different machines ordered usually in lots of ten, the material of the machines consisting mostly of castings, the machines weighing, say, from 300 up to 3,000 pounds. As soon as a lot of machines was ordered the castings were at once got out and we had a very good place for storing them entirely out of the way of everything and everybody. It was even in those days rather a hobby with me to keep out the impedimenta. I would only get in the castings when we were ready to go to work on them and then they would be rushed in quite suddenly. As a consequence the shop never had a crowded or cluttered up appearance, and some thoughtless and not well informed persons would sometimes think there was not much doing. It used to strike the proprietor that way sometimes when I had not been there more than a year or so, and then he would get some help and rush in the castings for three or four sets of machines and get them distributed around so that the shop would look much fuller of work, but all the men would be more or less hindered about getting around. I let things go that way long enough for the boss to see how the arrangement worked, and then I gave him a little talking to and after that he concluded that my way was most profitable, as everyone will find who will give it a fair trial.

The third class of impedimenta is the worst of all and the most frequently met with. It is not the finished work nor the material for new work, but it is almost everything else, and it is impossible to

make a list of it. The tool-room in the modern shop not only keeps all the small tools in good condition and where they can be readily obtained by whoever wants them, but it also keeps them from littering and obstructing the working spaces on the machines and benches. Unfortunately in many shops the tool-room still has nothing to do with the larger tools and appurtenances. There will be large boring bars and chucks and blockings and such things that still have no place but under the bench, or in the corner, or against the post, or sometimes in the middle of the floor, and there they repose until they are wanted, and after they have been used they are dumped again wherever there is a bit of unoccupied space. Besides those occasionally useful things there are all sorts of tools and riggings and appliances that have each served a useful purpose upon some special job, but which everybody knows will never be wanted again, and yet which no one has nerve enough to put out of existence. In extreme cases we may find things worse than this. The shop will be obstructed with spoiled and broken and hopelessly worthless machines or machine parts which no one will remove or destroy simply because they sometime cost so much. They are kept on account of their value when their value has all departed.

There is only one thing to do. Let everything in the shop prove its right to be there as contributing to the purposes for which the shop exists, and let everything else be anywhere else but in the shop. The effect of keeping things out of the shop which have no right to be in it is always operative upon the habits of the men. If it is complained that men are careless and throw things around or leave them around where they ought not to, it will always be noticed that there is a great difference between beginning the confusion and in contributing to it where it already exists. If you have a perfectly clean and unoccupied spot anywhere, no one will be likely to throw or to leave anything there, but as soon as you have a little accumulation of impedimenta in the same spot no one will hesitate at all about contributing to the growth of the pile.

TECUMSEH SWIFT.

Rapid Transit in Underground Railways.

Editor American Machinist:

Your explanation or reason why the man who fell six stories and, landing on an elevator, was not killed, is so pertinent to the scheme I had the audacity to present at a special meeting of the American Society of Mechanical Engineers several years ago, that I wish to put the proposition on record and give the reasons for my faith in its practicability.

The proposition embodies two leading ideas: one that two lines of rails only be run, and they to be one over the other, so as to make single station buildings available for going in both directions. This, if it had been adopted, would undoubtedly have reduced the cost of the lines now being laid down in New York very materially. Certainly the tearing up of the streets would have been greatly lessened.

The second proposition was to run all trains as express trains, and carry every passenger to his arriving station without making a stop, unless he so elected. My first idea was to run all trains at 20 miles an hour, though I now believe 30 miles an hour quite as feasible. The plan was to have trains composed of several cars follow one another exactly as they do now on the elevated road, except to go at a uniform speed; each car to be self-propelled and managed by a motorman at each end; each motorman to have control of the car, as far as coupling, starting and stopping are concerned; an illuminated dial to be placed on each car to indicate at all times the speed at which the car is running and to show the speed to the motorman in the next car also; all cars to have side doors, for taking on and letting off passengers, and end doors to lead from one car to another; the end doors to be locked whenever the car is detached from the train, and so arranged that the cars could not be uncoupled until the doors were locked. Every car to have at each end projecting sliding buffers with friction, under the control of the motorman; the tunnels to be lighted with two systems of electric lights, one system showing white safety and the other red danger lights, and the systems being divided in sections from station to station and controlled at the stations; the danger lights to be made absolutely reliable by a double system of dynamos and wires.

The road to be operated as follows: Let it be assumed that the trains of, say, six cars each, were to start from upper New York, and that a car had been left at every station the night before. Before the train starts, all red lights, or at least those for a given distance from each station, are on. When the train reaches a point within a certain distance from, say, One Hundred and Twenty-fifth street station, the car standing at that station starts and the red lights change to white, showing to the on-coming train that the road is clear. At the same time the car at the rear end of the train is uncoupled and stopped at the One Hundred and Twenty-fifth street station to let off passengers and to take on others. At some distance, which experiment would determine, the car that left the One Hundred and Twenty-fifth street station would have attained the same speed as the train, and the two coming together, they would be coupled, the end doors opened and passengers could go from end to end of the train, and this dropping off a car at the rear and the picking up of one ahead would be constantly going on at every station. At first sight it will appear a hazardous undertaking to attempt to run at full speed into a loaded car, but a few moments' consideration of the precautions taken to make it safe, ought to convince the thoughtful that it is perfectly feasible.

First, if the car at the next station has not started when it ought, the red lights would warn the motorman of the fact, and there would be, in a six-car train, twelve men notified of the fact, either one of whom could shut off the current and put on the brakes, bringing the train to a stop, or as soon as the car ahead did start there could then be just time to get up to the speed of the on-coming train, even thought it regained full speed, as soon as possible.

At first sight one would think that a train running at 30 miles an hour overtaking a car running 20 miles an hour would be equivalent to one running 10 miles an hour banging into a car at rest; but it would be nothing of the kind, and it is here that the man falling on the descending elevator supplies an illustration.

If a train running at 10 miles an hour approaches a car at rest, and has reached within 15 feet, it would have but a trifle over one second of time and 15 feet to slow up; whereas, if the train were running 30 and the car 20 miles an hour the train would go, if 15 feet apart and both kept the same speed, 45 feet and the car 30 feet before hitting, and if the train in going the 45 feet slowed down to 26 miles an hour, and the car accelerated its speed to 24 miles an hour, then they would have from 75 to 90 feet to do it in, and still be approaching at the insignificant speed of 2 miles an hour; besides, with the speed indicator, the motormen would know at exactly what speed they would be approaching, and could put the proper friction on the buffers to bring them up quietly. Thus, it will be seen that with only 15 feet between the train and the car, and the one slowing down and the other gaining speed, not more than street cars do, the two would come together without trouble.

The advantage of this scheme is, that only two lines instead of four would be required, and only one half the expense for station real estate. The cost of running the trains would be greatly reduced, as only a car and not a train would be stopped at every station. The service would be better than four lines could possibly be made to give if two were run as local and two as express, because by this plan every passenger would be carried at express speed and left at his desired station without changing—that is, by walking ahead or back through the train until he came to the car that stopped at the station he desired to stop at. If the train was a six-car train and he only wished to go to the fifth station he would walk back one car. Or again, if a passenger wished to go twelve stations and preferred to make one stop, he only need to take his seat and keep it. If he wished to go thirteen stations, he would walk ahead one car; or if eleven stations he would walk back one. There does not appear to be any question

about the scheme, except that of picking up the car ahead, there would be freedom from storms, which upset calculations, absolutely reliable electric lights as against half daylight and half artificial, as is the case overhead, and two or more men always on the watch.

To further add to the safety of the passengers, there would be no necessity for hurrying on or off the car, for there would be a full carload on rare occasions only and ample time would be assured.

The plan seems to me as safe as the reliability of man, and the perfection of machinery can make any.

JOHN E. SWEET.

[It is not safe to say that any scheme of Professor Sweet's is not practicable, but if he will go north, on the West Side elevated lines, during the evening rush hours and, getting off at 116th or 125th street, note the number of passengers that leave an express train at either of those stations, he will, we think, be disposed to qualify the opinion that "there would be a full carload on rare occasions only." New York never has had and probably never will have transit facilities equal to its needs. During the rush hours every car of every line is packed like a sardine box, and it is a serious question with us if the necessity for passing through the crowded train would not vitiate the entire scheme, even granting that it is, mechanically, entirely feasible. The writer has boarded northbound express trains at Rector street—the terminus for such trains—without being able to obtain a seat—every seat of a five-car train being taken by the passengers boarding the train at that first station and some being compelled to stand.—Ed.]

Who Knows About This?

Editor American Machinist:

It would be a matter of some importance to me, and to others as well, to receive some information as to the methods employed and appliances used in turning

SWASH TURNING.

balusters and other work on a rake, as shown in the diagram sent herewith.

This kind of turning is called "swash turning," and formerly was very popular for stone and wood balusters, for steps leading to hall or other main entrances.

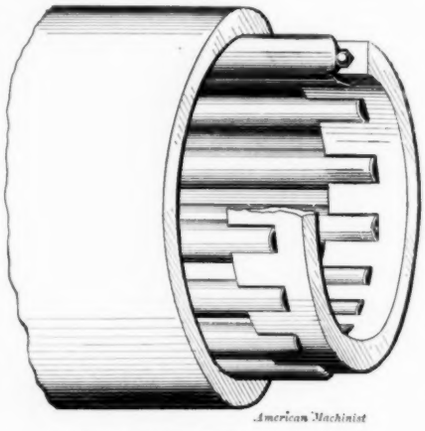
CURIOUS.

Roller Bearings.

Editor American Machinist:

At page 851 you publish an article by "S. Y. P." relating to roller bearings, which we feel requires an answer. We appreciate the fact that your correspondent has had any trouble with the bearings he has tried, but it is manifestly unfair to condemn all roller bearings, and the principle generally, merely because a certain bearing has proven a failure. If all mechanical equipment was criticised in the same manner and upon the same basis of reasoning, there would be very little progress.

For a number of years past, the writer has devoted his time and attention to the manufacture of roller bearings, and has come to the conclusion that the only proper method in which to make such a bearing is to have solid rollers properly spaced and held by a cage, all of the rollers being thoroughly hardened and ground, accurate to size. Such a bearing should run either upon a hardened shaft or upon a hardened



ROLLER BEARING WITH END BALLS.

steel sleeve forced upon the shaft, with a similar sleeve to enclose the rollers outwardly. A bearing constructed upon these lines will last for an indefinite period, either for cranes, such as "S. Y. P." specified, or for railroad or other work, provided that all parts are properly designed. It is not easy to manufacture a bearing from the above specifications, as the proper degree of hardness or temper is one that only experience can demonstrate. When all parts of such a bearing are made accurately, not varying over one-half thousandth of an inch in size and thoroughly tempered there is nothing about the construction that will break or wear out.

One weak point in roller bearings is that the roller wears upon the cage, or whatever it comes in contact with. This is occasioned by the fact that the roller runs much more rapidly than the shaft upon which it revolves. If, for instance, the shaft runs at 200 revolutions per minute, each individual roller will run many times that speed, governed by its diameter and that of the shaft, and this creates an end friction which will grind out the cage which contains the rollers, or whatever else they touch at that point. A single ball set in the cage at the end of the roller entirely stops this wear and friction, keeps the rollers in perfect alinement with the shaft, and prevents the cage from wearing out.

In reference to the saving accomplished by the use of a roller bearing, it is so easily demonstrated that it seems almost superfluous to give details. On shafting, according to the manner in which the bearings are used, it varies from 25 to 60 per cent., and the same applies to any construction wherever a roller can be used. A test made by the United States Government is shown in the accompanying table which gives the results of a series of tractographic tests of U. S. army wagons by Mr. E. G. Hamson, road expert of the U. S. Department of Agriculture. The tests were made on various kinds of roadways both level and with a grade. Mr. Hamson states in his report that because of recent storms the roads were not in good condition:

	Pounds Pull.
Asphalt, test with common axle....	100
Asphalt with roller bearing axle....	25
Asphalt with common axle, starting load.....	450
Asphalt with roller bearing axle, starting load.....	220
Asphalt with 8 per cent. grade, common axle.....	400
Asphalt with 8 per cent. grade, roller bearing axle.....	170
Belgian block, common axle.....	165
Belgian block, roller bearing axle....	75
Dirt road, common axle.....	260
Dirt road, roller bearing axle.....	100
Dirt starting, common axle.....	850
Dirt starting, roller bearing axle....	400

Experience has demonstrated that the saving is equally as great on all classes of machinery as is represented in this test. This is proven by the use of roller bearings on mine cars, where by their use one man is able to push a loaded car more easily than three or four men can push the car without roller bearings.

BALL BEARING COMPANY,
by S. S. EVELAND.

[We fail to see that the ball placed as shown in the illustration would act in any way except as a pivot. It may, however, be a very good pivot and that probably accounts for its satisfactory performance.—Ed.]

Paint That Shows the Lack of Oil.

To indicate when the moving parts of the machinery have become excessively heated a German inventor has devised a paint composed of an amalgam of the iodides of mercury and copper, which the inventor claims will change color when heated. Bearings to which it is applied are red under normal conditions, but when a temperature of 140 degrees Fahr. has been reached the paint becomes black.

Smoke Abolition.

Editor American Machinist:

I am somewhat sorry to see that Mr. Tecumseh Swift has joined the ranks of smoke pessimists. While I agree with him that the time must come when power will be derived from gas producers and gas engines, I see no reason whatever for smoke to be produced even where coal is burned under boilers. Soft coal can be burned "out of sight," as Mr. Swift says —that is to say, away from the cities—but it seems to me that where much coal is being burned in the process of producing electrical energy for use in the smokeless city, there will rise up very much of another city.

I have argued for a long time on the smoke question. At one time factory chimneys began to get better here, for people got on to the way of so firing their boilers that they became moderate in their smoke-producing powers. Ordinary well-arranged furnaces in internally fired boilers can be worked fairly well with extra air admission, because the products of such furnaces are all swept together along the furnaces and burned at the bridge. The trouble was that the furnaces being arched over with water-cooled plate took so much heat out of the gases that these would not always complete their combustion satisfactorily, and, to make matters worse, boiler-makers who made an extra few shillings profit per pipe would persuade their customers to allow them to put cross water pipes with tubes beyond the bridge. These helped to knock out the flame and produced smoke. No boilers were so clean as the plain tube boilers, free of those worse than useless £2-apiece water pipes.

In time the water-tube boiler came along in large numbers. It is said to have been a product of the anthracite-coal district of America. As arranged, it is hopeless as a smokeless boiler. The gases from the furnace rise straight up among water pipes that are hundreds of degrees colder than the temperature necessary for smokeless combustion of bituminous coal.

Mr. Swift calls it silly and profitless to talk about burning soft coal without smoke. It is not silly; it may be profitless because of the ignorance of people who ought to know better. But I know that it can be done by following out the principles we were taught at school. My old chemistry professor was accustomed to take a cone of platinum wire and by aid of its heat-conducting power he would so abstract heat from a candle flame that the candle was extinguished. Further combustion could not take place in the absence of sufficient temperature. This experiment was a very proper one to make, but it was not made to show engineers what to do, but what to avoid. Engineers have not avoided it. They have consistently arranged their boilers so as to abstract heat from the burning gases so rapidly as to extinguish them. The question of combustion is almost entirely one of temperature. Given the mixture of the gases, which the ordinary water-tube boiler does not give, and the gases will burn absolutely smokelessly.

Mechanical stokers will not alone secure perfect combustion, neither will patent grates, but a properly arranged refractory furnace will do it. Water-tube boilers have been arranged on the lines I have so frequently urged. They never produce smoke and they do their work with as little fuel, and that of the most smoky order, as any other boilers on similar duties. Knowing that smoke is unnecessary it appears to me very silly and very profitless to say it is impossible to burn soft coal without smoke and to use expensive smokless coal at double the price. What we here call smokeless Welsh will turn out black smoke if burned in the ordinary furnace of water-tube boilers. To condemn one portion of the people to live in Smoketown in order that the remainder may live in Clearville is evidently wrong. There is not even the excuse of necessity, for it is a fact that here may be seen two electric stations side by side, both with the same water-tube boilers. One chimney pours out smoke all day, the other stands apparently idle. The production of smoke is a crime against chemical knowledge. We are all taught as engineers how to burn things and we nearly all go the opposite way. Even when college professors of engineering become responsible for a steam plant they chuck their knowledge to the winds and descend among Circe's following to wallow in the smoke from their own evilly designed furnaces.

If Mr. Swift's ideas were put in practice and smoke allowed to be made away from the cities, how much better off would the country be? The cure would be worse than the disease, and the disease is preventable, unnecessary, costly and, like most disease, the outcome of ignorance—and the worst sort of ignorance, because knowledge is so cheap.

Anthracite coal is responsible for the present smoke of New York and it is responsible for the growth of the smoke nuisance in London; for if it had not been for anthracite the common type of water tube boiler would never have grown to the numbers it has. It would long ago either have died as a nuisance or it would have been set in a rational manner and would have been clean. It has not pleased the Almighty to withhold from us the knowledge of how to burn coal. We all know how to do it. Some few do it by following His rules. The rest of us know better than the Almighty and try to do without the Almighty's plain rules. Result—miserable failure. When I read of the impossibility of burning soft coal without smoke it makes me tired. It is not easy always to do it on old boilers, but there is no excuse for not doing it if we start out properly with the building in of the boiler. No man who has a smoking boiler ought to be allowed any light in his rooms, except what he gets from a kerosene lamp without an open central tube. If black smoke were as heavy as it looks to be its production would cease quickly. Most men appear willing to pay more money away in smoke fines and dear coal than to pay for advice and firebricks to put matters right.

When smoke has been cured there will still remain the sulphur to trouble us. This would disappear with the gas producer. In the meantime, as we do know how to prevent black smoke we ought to do it and leave the sulphur until we learn to get rid of that also—a process that seems to me more likely to accompany a mechanically produced draft than a chimney draft.

When a man sets out to sell a boiler, the fear of smoke laws are not in him. He sells his boiler to be built up with the smallest possible amount of brickwork, lest the cost of bricks should be added to the cost of the boiler and prejudice the sale. The men who have sold water tube boilers have either wilfully ignored or have been really ignorant of the prejudicial effect of the cold arch of water-protected plate which surrounds the whole furnace parts of the Lancashire, Scotch, Cornish or other internally fired boiler. In place of avoiding this fault, as they so easily might have done, they have intensified it by deliberately throwing away the advantages of the water tube boiler and so setting it as to render it worse than the internally fired boiler.

When one knows that Mr. Swift's pessimism is warranted only on the assumption that the ordinary system of boiler setting, handed down from an ignorant past, is the one and only system, is not one justified in deploring such pessimism? Nowadays we don't see people writing that typhus fever is obligatory. It is known to be a water-borne, filth disease. Modern sanitation employs means to prevent drains ventilating themselves into houses, and we cease to look on diphtheria as a visitation of the Almighty and deplore it as due to neglect of known laws. Black smoke is just as much a crime against knowledge as is cholera or typhus, and it is time that the same pressure should be brought to bear on its producers as would be brought to bear on the man who deposited refuse in the public street.

I do not write thus because I have simply thought this matter out, but because the laws of combustion which I urge have in a few cases been followed out with complete success and have exploded the false idea that smoke is inevitable. It is inevitable if steps are taken to make it so, and I would add that the manufacture of lampblack is carried out on the same system as the ordinary method of soft coal combustion under steam boilers—namely, with insufficient air at as low a temperature as possible, and it succeeds every time and teaches that the absence of

the lampblack equivalent is simply a question of the opposite conditions, which can easily be secured with economy of coal.

London. W. H. Booth.

Boring and Accurately Finishing a 5-Inch Cylinder

Editor American Machinist:

In a recent issue of your paper Mr. Tecumseh Swift discussed a question raised by one of your correspondents respecting the limits of accuracy possible in boring a 5-inch hole in a pulley hub. As intimated by Mr. Swift, there is no special difficulty in boring such a hole sufficiently accurate for the purpose indicated. Boring a long hole—10 inches or longer—with a common tool held in a tool-post with one set-screw is, of course, a slow and tedious process. There is, however, little excuse for using such an arrangement when a good fixture and cutter bars can be so cheaply made.

I submit herewith illustrations of a method recently used in the machine shop of the Michigan Agricultural College for boring a 5-inch hole where a high degree of accuracy was imperative. The drawing shows a cylinder with bore 5 inches diameter by 11 inches long, and with the head, where the stuffing-box is usually placed, cast integral with the cylinder. The piston rod was 1¼ inches in diameter. It is easy to see that the cored hole for the piston rod, being only about 1 inch, was too small to admit of the cylinder being bored with the usual boring-bar arrangement. This cylinder was part of a dynamometer to be used in a traction test, which work was assigned Messrs. Peterson, Shedd, Richmond and Millspaugh as their graduating thesis. The pull (of more than 275 pounds per square inch) was to be transmitted to a gage on the end of the cylinder by means of oil between the piston and the solid head. It was deemed expedient to so design the apparatus as to dispense with packing in connection with both the piston and piston rod, and it was this feature that necessitated the accurate fitting. It will be suggested that the head should have been made detachable to facilitate boring and lapping. It will not be necessary to explain why the head was cast integral, except to say that the students preferred to avoid a joint between cylinder and head, and experience demonstrated that there were no serious constructional difficulties in that design.

The first method proposed was to bore the hole for the piston rod in advance and use it as the guide for a boring bar. Other methods were considered, but the one finally adopted gave very satisfactory results. It was as follows: The cylinder was chucked in a 24-inch engine lathe with the open end outward, the pressure of the chuck jaws being directly over the cylinder head to avoid springing the casting. The large and small holes were then roughed out with single-ended cutters *A* in a cutter bar *D*, Fig. 2, the cutter bar being held in the tool-post fixture, Fig. 3. Two double-ended cutters were next made of round steel to fit a round hole in the boring bar, as at *B*, Fig. 2. The cutting edges of these cutters were turned in the bar on lathe centers, the longer being for the final bore and the other somewhat shorter. These cutters, after being backed off and tempered, were used in the cutter bar to bring the hole to the final size. Being made to cut on both ends and the last cutter having but little to cut, the difficulty of making a long hole parallel was overcome. The final cutter served as a kind of reamer, or sizer.

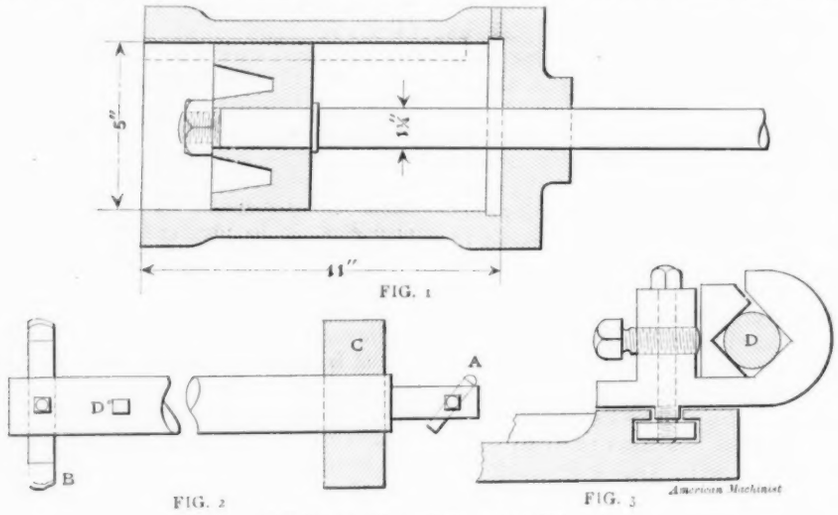


FIG. 1. FIG. 2. FIG. 3.

BORING AN OIL-TIGHT CYLINDER.

The next step was to finish the small hole concentric with the 5-inch bore. As left by the previous boring, it was already nearly enough concentric for ordinary purposes, but we were unwilling to trust to such accuracy as could be obtained with a long bar supported at one end only. A collar was bored and turned to tightly fit the 5-inch hole. This collar was secured near the end of the bar, as at *C*, and served as a support for the overhanging cutter. With this arrangement there was no difficulty in boring the 1¼-inch hole concentric with the bore of the cylinder. Having accomplished this the collar was afterwards used as a lap with which to grind out the cylinder. During this operation the bar was held in the fixture as before, and, with the lapping collar, was fed back and forth by the lathe-feed mechanism through the bore, the cylinder rotating at the same time. A collar was made for the 1¼-inch hole and that was similarly lapped. The lapping process for both holes was continued until no error could be detected with gages improvised for the purpose. The piston and rod were turned and ground to fit the cylinder on a Brown & Sharpe universal grinder, which completed this part of the apparatus. With a pressure of 286 pounds per square inch there was practically no leakage, and the job was highly satisfactory. The machine work on the cylinder and piston was done, under the direction of the foreman, mainly by Mr. Richmond. Mr. Richmond was assisted by Mr. Garthe, a student in the Junior class.

W. S. Leonard,
Foreman of Machine Shop, Michigan Agricultural College.

Cold Forging in the Punch Press.

Editor American Machinist:

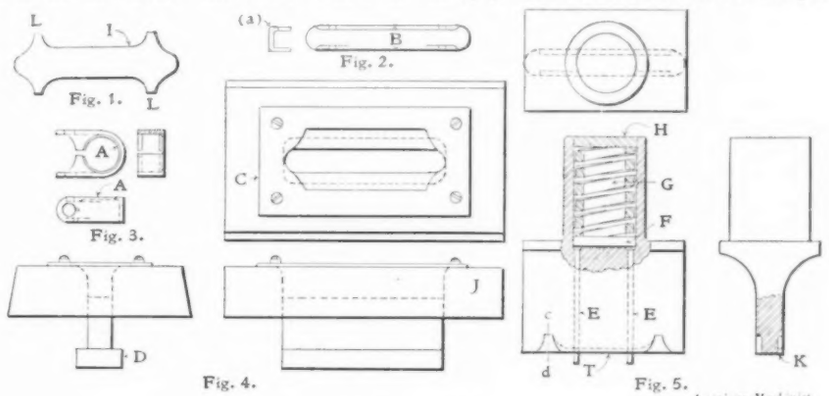
In the accompanying drawings Fig. 1 is the blank for a bicycle handle-bar clamp, Fig. 2 is the result of the first forming operation and Fig. 3 is the finished clamp. In Fig. 3 at *A* a flange is formed to cover the slot in the fork stem. This flange is the inspiration of this description.

Fig. 4 represents the forming die *J* with gage plate *C* and knockout pad *D*. Fig. 5 shows the punch with a partial section through the shank and also on line *c d*. The pieces stick on the punch, requiring the knock-off pins *E*, back plate *F*, spring *G* and plug *H*. The metal for the flange and projections *L*, Fig. 1, must be formed so as to leave sharp corners all around the finished clamp. The blank was left full at I, Fig. 1 (one side only) and set slightly to one side on the die *J*, Fig. 4, as shown by plate *C*. The die is held in a shoe similar to that in Fig. 6, which has a knockout stem *Q* forced upwards by a spring not shown. When not in action the top of pad *D* is slightly above the upper face of die, *J*. The punch on the down stroke holds the blank firmly against the pad *D*, and as it advances turns up points *I* and *L*, Fig. 1, the blank gradually shifting till it becomes central in die. The metal at *I*, Fig. 1, forms over the round corner *K*, Fig. 5, the whole piece taking the shape of Fig. 2. The metal is .134 inch thick and ⅝ inch wide at *B*, which renders this operation difficult.

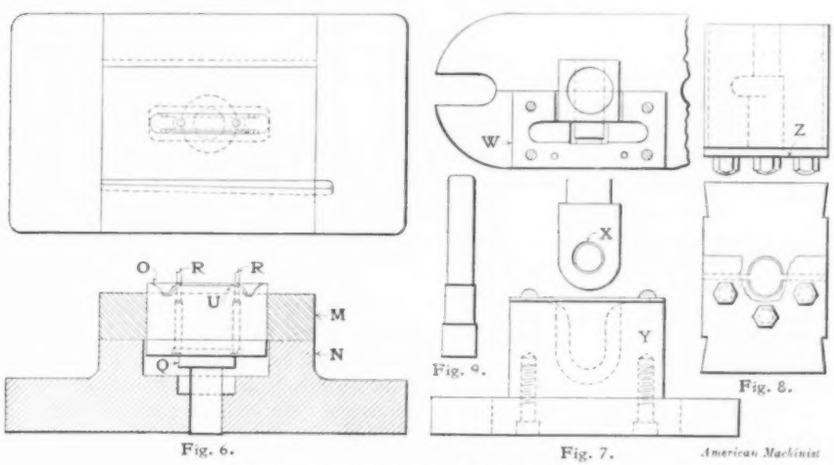
Next, we have the second forming die *M*, Fig. 6. This die is keyed into the shoe *N* and has a pad *O* resting on stem *Q*, which is worked by a spring not shown. Pad *O* has two knockout stems *R* riveted into a cross piece as shown. This pad also has a recess at *U* to form

the flange *A*, Fig. 2. The punch is practically the same shape as Fig. 5, without knockouts and having a plane face at *T*, which fits closely in the hole in the die. This fit must be close or the metal will creep up between punch and die and leave a bad fin around the edge. The same applies to the fit of the pad in the die.

If a piece of sheet metal is allowed to "flow," without stretching, around a sharp cornered punch, the outside edge will form part of a circle whose radius is approximately the thickness of the metal, as at *a*, Fig. 2. On this clamp the corners *must* be sharp, so it is necessary to allow surplus metal on projections *L* and *I*, so that, the piece shown at Fig. 2 being placed with the projections down, corner *a* on the side of recess *U*, at the completion of the down stroke the metal is forced out into all the corners and also to form flange *A*.



HANDLE BAR CLAMP AND DIES FOR FORMING IT.



DIES FOR FORMING HANDLE BAR CLAMP.

Fig. 7 shows the folding punch and die. The work as left by the second forming operation, having been pierced for the clamp bolt, is placed in gage *W* with the projections up, and the punch is brought down into die *Y*, folding the work over *X*, leaving hole *V* large, so that the swaging arbor, Fig. 9, will freely enter.

Fig. 8 shows the swaging dies. In operation, the work as left by the folding dies is placed over the arbor so that the square shoulder will rest against the inside of the flange, then laid in the lower die with the large end of the arbor resting against plate *Z*, click goes the clutch, and our job is complete.

The second forming operation, Fig. 6, requires good judgment in the selection and working of the material for the tools, as the strain is very great, especially on pad *O*. This should be made of a medium grade of steel, "tough as well as hard" being the requirement.

The flow of metal in some of these operations is so much like forging, hence the title of this article. E. E. MINARD.

Cleveland, O

Steam that Would Not Drive.

Editor American Machinist:

Some years ago a company installed a costly plant on Atwater street for the purpose of generating steam and supplying it to customers for heating and power purposes in the numerous wholesale, retail and manufacturing establishments in the vicinity. Somehow the venture proved a financial failure and the plant was eventually closed and dismantled; why I never satisfactorily learned, beyond the assertion of a gentleman connected with a wholesale establishment within about two blocks of the boilers, who told me that with a gage pressure of, I think, 100 pounds per square inch near the engine, the steam seemed to be dead, and certainly incapable of running their machinery, causing the firm to close its connection with the steam supply company and to use their own boiler, which had been permitted to rest during the trial of the new and, it was hoped, cheaper method. With the steam from their own boiler at 60 pounds on the gage, or 40 pounds per square inch below the record on the same gage of the steam supply company's product, all went merry as a marriage bell.

Why the difference, and where? Was it real or imaginary? Or was it not rather that the steam had condensed so much that it was almost entirely a water pressure on the working (?) gage, forced up by the pressure of live steam at the boilers? Have other steam supply plants acted likewise? I. W. P.

[We of course cannot undertake to explain the above when only "hearsay" evidence is offered. The steam gage in either or both cases may have lied. In connection with the steam supply company the engine may have been asked to run as a hydraulic engine, which it rarely does satisfactorily. The one thing apparently most evident is that there was not sufficient engineer pressure in the case.—Ed.]

Junior Architectural Draftsman.

The United States Civil Service Commission announces that on October 21, 1902, an examination will be held. Information relative to the subjects and scope of the examination may be found in section 53 of the Manual of Examinations, revised to January 1, 1902. Age limit, 20 years or over. From the eligibles resulting from this examination it is expected that three or more vacancies in the position of junior architectural draftsman in the office of the Supervising Architect, at a salary of $840 per annum, will be filled. The Commission has experienced difficulty in the past in securing a sufficient number of eligibles for this position, and it hopes that all persons who are qualified and who desire to enter the service will apply for this examination.

Persons who desire to compete should at once apply to the United States Civil Service Commission, Washington, D. C., for application forms 304 and 375.

The United States Civil Service Commission announces that on August 26-27, 1902, an examination will be held for the position of assistant examiner in the Patent Office. Information relative to the subjects and the scope of the examination may be found in section 41 of the Manual of Examinations, revised to January 1, 1902.

Persons who desire to compete should at once apply to the United States Civil Service Commission, Washington, D. C., for application forms 304 and 375, which should be properly executed and filed with the Commission at Washington.

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Molders for Molding.

We reprint in this issue the principal portion of another of the unusually excellent series of practical papers presented at the recent meeting of the American Foundrymen's Association. The paper briefly but clearly tells of the method adopted in a certain foundry to increase the relative and actual output, so that it could keep up with the demands of the machine shop which it was its function to supply. The method adopted was simple and commonsensible. The molders were allowed to put in all their working hours in molding, and the hard work at both ends of the day which does not call for the molder's skill, but which it has been the traditional custom of the trade for molders to do, was relegated to unskilled hands that could do it quite as well or perhaps better, and certainly much more cheaply. The anomalous thing is that there should be any opportunity to tell such a story as this or that the practice recommended should not have been adopted in that foundry and in every other years ago. The work of shaking out the flasks and taking out the castings, of shoveling over and tempering the sand and of handling and pouring the molten metal, except in rare cases, was never legitimate work for a highly skilled molder. It not only occupied a large fraction of his valuable time, but it actually impaired his skill and reduced his efficiency for the actual molding operations. Molding work is surely hard enough work for any man, without the unnecessary addition of any portion more exhausting. We are well aware that for years there has been a breaking up of the old practices in the large specialty foundries, and that there the molders have been largely emancipated, but in the general machinery and jobbing shops the old traditions and practices still largely prevail, and they cannot be too soon abolished.

While from time immemorial molders have been molders only a part of each day, machinists have generally been machinists from one whistle blow to the other, so that here would seem to be no lesson for them. This is not so sure after all. There are still machinists and machinists, and much is still to be gained in rightly apportioning their work. There is work that demands the highest skill and judgment attainable, and then there is much other work that any so-called machinist can do. The grade of skill required for roughing out and that required for finishing most lathe work, for instance, is distinctly different in its exactions. Why should the best finisher, the most reliable maker of fits, waste his time, speaking comparatively, in doing the rough turning and the preliminary work? And there is not only the man but the tool to be considered. It is very desirable to have some tools that shall be as accurate and reliable as possible for the finishing operations, and it is equally desirable to have tools of strength and stiffness, with coarse feeds for making as much chips as possible, and these characteristics can never be combined and maintained in the single tool as well as in two or more tools. There can no more be any objection to the suggested arrangement on the ground that the man who begins a job in the shop has a "right" to finish it, because, as a matter of fact, in these days very few men begin and finish a job. The general practice is to pass the work from one machine to another, and therefore also from one man to another, and we are merely suggesting the looking out for additional opportunities for this generally profitable practice.

The American Society of Mechanical Engineers Misrepresented.

The "New York Correspondent" of *Engineering*, in his report of the Boston meeting of the American Society of Mechanical Engineers, thus misrepresents and slanders those members of the society who think there is a chance for improvement in the society's methods and who are sufficiently interested in the society's welfare to try to bring about such improvement. The report says:

"The next morning the business meeting occurred, chiefly remarkable for amendments which were voted down, and discussions to which only the discussors paid much attention. Several speakers showed a most lamentable ignorance of their subjects, and made unwarrantable assertions not at all borne out by facts. The great idea in many speakers' minds was to find fault with somebody or something, no matter what the facts were. They did it pretty thoroughly, and it was very much in result like the large man whose very small wife used to whip him. Someone reproached him with allowing this. "Oh," he replied, "it amuses her and don't hurt me one bit." No one would have believed there were so many fault-finders, but they were probably all present, and made the most of their opportunities. The affairs of this society have been well administered from the outset, and under the able guidance of its distinguished secretary there could be no other result. The society as a body is to be congratulated on having a man in that position who can always say and do the right thing, not only at home, but abroad. It was due to his tact in 1889 that this society took the position it did among the American engineers in Europe. The croaking of the malcontents will not hurt him in the least, and they are few in number.

. . . . . .

"There were undoubtedly some honest and disinterested speakers in this arraignment of Professor Hutton, for such was the character of the discussion; but, unfortunately, they were not well posted in the situation and misunderstood the matter entirely. In time they will see the error of their ways and feel mortified at their misdirected zeal. Your correspondent feels quite strongly on the absolute

injustice done to the secretary, for, as one of the original members of this society, he knows the services Professor Hutton has rendered, and that no amount of money could liquidate the obligations the society owes this faithful officer.

. . . . . .

"To return to the meeting. As the fault-finding had been inaugurated, it was distributed generally among the various committees who are trying to serve the society because of their interest in its welfare, and not from any personal motive. Such committees are always considered marks for the discontented in every organization, but the attack never has any weight with the members at large. One member brought his annual charge against the publication committee because of the papers submitted, seeming to forget they do not furnish papers themselves, but only select the best from those offered. The writer would suggest to him that he could render the society more service if he would devote some of his time to preparing a paper, which he is well able to do, instead of abusing a committee that is trying to do its best with the material presented. However, he proposed a larger committee, with at least two experts on each subject. The committee on the metric system were scared because some of them had opposed this system before the Congressional committee, but this attack fell rather flat, and the meeting then took up professional papers."

It is needless to say that not a single American technical journal could be induced to publish such stuff. The men connected with them know the facts too well.

Though Professor Hutton, like every other man who occupies a prominent position, has his personal enemies, no one, so far as we are aware, who has taken a prominent part in the recent discussion of the society's affairs fails to recognize and to give him full credit for his devotion to the society and for his very great ability. The present movement for the betterment of the society's management cannot be made to assume the form of a personal attack upon Professor Hutton, and no one would have the cheek to try to make it do so by the use of the columns of any American journal.

The main facts are (we state them for the enlightenment of *Engineering's* editor) that the society had fallen behind to the extent of about $15,000, apparently without anybody knowing it; the expenses of administration *per member* had increased without anybody being able to give a good reason therefor. In this situation an increase of dues was proposed which led to an investigation and has already resulted in changes and improvements which no competent business man could fail to approve of and which in fact are highly approved by some of the best business men in New York; members of the society, devoted to its interests and entirely friendly to Professor Hutton.

In view of these facts of record, it is possible for one to honestly hold the view that the affairs of the society have been well managed; but to go further and say, in effect, as the "New York Correspondent" of *Engineering* does, that the society's methods of conducting its affairs are and have been beyond criticism; that those who presume to criticize them exhibit "lamentable ignorance" or show that their "great idea" . . . was to find fault with somebody or something," is to entirely misrepresent the facts, and to call such members "croakers" and "malcontents" is not decent. To Professor Hutton we extend our sympathy. It must be very embarrassing to him to have such a defender.

No American journals, and very few members of the A. S. M. E., have descended into personalities in connection with this discussion of the society's affairs. On the contrary, the discussion here has been confined to methods and policies and has been, for the most part, conducted upon a distinctly high plane.

The distinction of going into personalities and of calling names is reserved for the "New York Correspondent" and for *Engineering*.

Some Prices.

Something of the difference between the industrial situation in America and in Europe at present and also something of the way in which those who are in a position to do so may discourage machine building enterprises is shown by the experience of an engineer who has been designing a machine of his own invention and in the construction of which he needed certain columns which must have properties possessed only by nickel steel. He asked the two concerns in America furnishing nickel steel forgings for prices upon the columns and these prices when quoted were practically the same from the two concerns and so high as to practically prohibit the construction of the machine. In this dilemma the engineer asked for prices from Krupp and obtained quotations at a little less than one-quarter the prices charged by the American concerns, delivered, duty paid and with the delivery in half the time. On other pieces for the same machines the American prices amounted to $14.75 per pound, wheras the prices from the Krupp establishment were only $3.50 per pound for exactly the same thing. No one of course will deny that the Krupp product is at least the equal of any other in the world.

Sale of Dynamite Guns Enjoined.

We noted at page 996 the sale of the dynamite gun plant, and it is now announced that the sale is illegal, the government having obtained an injunction against it. It seems that the sale was made at the instance of Franklin Patterson, who was connected with the Dynamite Gun Company. Upon the failure of the company, he had secured an attachment for $300,000 against the plant. It was to satisfy this attachment that the sale was made, Congress having refused to make an appropriation to satisfy Mr. Patterson's claim. The government, however, claims that the property constitutes an important part of the coast defences and that Patterson should wait until Congress has again passed upon the matter and made an appropriation.

We suppose that no one can guarantee or give Patterson any idea of when Congress will be pleased to pass such an appropriation, if in fact it ever does. Cases have been known in which Congress has repeatedly refused or failed to pass appropriations to meet obligations clearly due by the government to individuals—claims which no honorable business man would think for one moment of denying.

A Plea for Technical Education for the Mechanic.*

While our educators have been discussing mere theories and methods and have been building a Chinese wall about their so-called superb school systems, shutting out all who were too large to walk through the narrow gateways which they themselves had made, private enterprise [in the correspondence schools] has discovered that half a million young Americans outside the walls were hungry for a technical education. Since they were forbidden to enter the sacred city, technical education has been sent out to them. When the history of education shall have been written, no greater reproach will rest upon the educators of this decade than their failure to hear the call of this multitude for an education suited to their needs. Technical education is one of the greatest needs of an enlightened democracy and should not be left to private enterprise. With State normal schools where young men and women can be trained for teaching, with State universities furnishing instruction in agriculture, dairying and stock-raising, besides training engineers and librarians—technical education supplied at State or national expense—it is evident that we are irretrievably committed to the policy of providing technical education at public expense. If the farmer's son can secure at the State university free instruction in scientific agriculture, what good reason is there for depriving the son of a mechanic from securing free instruction in engineering practice, machine tool work, or any other industrial calling, at the city technical high school? The answer of the schoolmaster that the public schools are intended not to teach trades but to develop character, citizenship and general culture, is totally unsatisfactory. We must remember that in order to become a good citizen a man must first secure a livelihood by honest toil; that whatever conduces to greater industrial efficiency in the individual increases the national prosperity and indirectly improves citizenship. Tech-

*Victor C. Alderson, Dean of Armour Institute of Technology, in *Journal of the Western Society of Engineers*.

nical education does this. Furthermore, if it is proper to train civil engineers, stock-raisers, butter and cheese makers, librarians and the teachers themselves at public expense, why should machinists, enginemen, carpenters, plumbers and house painters be excluded? No cleavage line can be drawn. If technical education is a good thing for one class it is equally good for others. Hitherto the ranks of such workers have been supplied by the influx of foreigners trained abroad, aided to some slight extent by apprentices from selected industries. But we should not, as a nation, depend upon any such uncertain supply. We should follow the example of Switzerland and, recognizing the dependence of national prosperity upon technical education, set about the task of providing an education for all classes of workers suited to their lives. The technical high school, if properly equipped and put in close relationship with the trades and industries, will satisfy this national need; it will not be a copy of the European trade school, but rather an adaptation of the trade school which will be in harmony with American thought and American educational ideals.

Industrial warfare is not a new idea, but its sociological effect in giving impetus to technical education during recent years is noteworthy. We are familiar with martial warfare. Our newspapers for the past few years have been teeming with reports of battles, of warfare, of disease and death as the concomitants of war; we have been called upon to pay homage to the prowess which has conquered our enemies on land and sea; we are playing the part of hero-worshipers as we have not done since the Civil War. But in the midst of all this clamor there has been going on—largely unknown and unnoticed—the most bitter, the most relentless war in the history of the world; a war not for territory, not for naval nor military glory, but for wealth, for industrial supremacy—a contest of brain with brain, skill with skill, economy with economy, technical training with technical training. It is only another example of the "struggle for existence." The war in South Africa or the Philippines is less fatal to the workingman than the ceaseless competition of similar workingmen in other countries. It is this unremitting rivalry between workers of the same class the world over that makes the cultivation of the workingman's powers by means of technical education an absolute necessity. That nation that neglects to equip its workmen with the armament of industry—technical education—will surely be defeated and become a decaying nation. These workers should receive immediate and thoughtful attention, for they are the bone and sinew of successful national and industrial life. That they should be technically trained through the medium of the technical high school is at the present time the greatest economic need of the American people.

The Clock and Watch Trade in Austria.

United States Consul Fred. W. Hossfeld sends us from Trieste some interesting particulars of the clock and watch trade in Austria. The clock industry in Austria is 200 years old, and half a century ago the clocks had a world-wide renown. The wheels were of wood, until by German competition brass became compulsory. As the Austrian clock trade was declining, a horological school was established, the influence of which was felt throughout the empire. The school has not developed modern enterprise, and Austrian clockmakers import from Germany the wheels they use. There is no watch factory in Austria, so that large numbers of watches are imported, 90 per cent. coming from Switzerland and only a fraction of 1 per cent. from the United States. The superiority and cheapness of the American watches are of little avail in the introduction of the watches, on account of the stringent and absurd customs regulations concerning gold and silver and their alloys.

The consul has this to say in general about the policy of sending American salesmen to Europe:

"Foreign agents, if intelligent, industrious and reliable, may be employed to advantage at times, but they are rarely as efficient as American salesmen. Satisfactory and permanent markets for our manufactured goods can, in my opinion, be best established abroad by our own salesmen who are familiar with the customs and languages of the people among whom trade is sought. So far, comparatively little has been done in this direction. I believe that none of the great commercial nations of Europe employs as many traveling salesmen at home and sends as few abroad as the United States. This alone accounts for the fact that some of our most advanced industries are as yet practically without a foreign market."

Peculiar Effects of Lightning.

On the 16th of July, during a thunder shower, the engine-room of the Comstock-Cheney piano-action factory, Ivoryton, Conn., was struck by lightning. The lightning stunned the night-watchman, set fire to the room, and in some unaccountable manner started the fuses of the automatic sprinkling system, the water of which fell on the watchman and revived him so he was able to turn in the alarm. If he had not done this so soon as he did, a great deal more damage would have been done; as it was, the large driving belt was destroyed, and considerable damage done in the room next to the engine-room.

WEBB.

Necessity is said to be the mother of invention, and from the severe demands she makes I sometimes think she is a stepmother. One of the laziest men I had was put at the job of shaking sand through a shaking sifter, and I thought I had him where there was no dodging. He worked along until noon, and when he came back from his dinner he brought a roller skate, cut it in two parts, and had that sifter on wheels, doing double the amount of work with half the labor. He has been relieved of the doubtful distinction of being called "Lazy Joe" to a position more in keeping with the intelligence he has made it evident he possesses.—*The Woodworker.*

It is announced that the Massachusetts Institute of Technology will establish a course designed to teach students the art and science of designing big guns and the plan is to adapt the course to graduates of Annapolis and West Point who may wish to pursue their studies along the lines indicated.

The Elmira *Gazette* publishes a very good abstract of our article about the workman who actually fell a considerable distance yet encountered results due to a much shorter fall, and then remarks as follows: "The AMERICAN MACHINIST having worked out this problem so skilfully, the *Gazette* ventures to present another. 'Miss Ernestina Valso, of Paterson, N. J., fell down a precipice 60 feet high the other day, landing upon the rocks at the bottom, and did not break a bone.' The dispatches say so. How does the AMERICAN MACHINIST figure this out?" We do not figure this out. It is a problem for a doctor.

Technical Publications.

"New York Rapid Transit Tunnel." 56 9x11-inch pages, fully illustrated. Rand Drill Company, New York.

This pamphlet, while primarily a fine piece of advertising enterprise, is at the same time the most striking and instructive description of the great work now in progress in this city that we have seen. Its illustrations include maps, profiles and numerous half-tones from photographs of the work in progress. The magnitude of the work, the upset condition of New York's streets and the difficulties of construction due to the network of pipes, sewers and conduits below the street surface are strikingly shown in a series of illustrations, and the text gives a concise history of the undertaking, explanations of the engineering difficulties, descriptions of the constructive methods and details, and brief accounts of the plants installed by the contractors.

"An Elementary Book on Electricity and Magnetism and Their Appliances." By D. C. Jackson and J. P. Jackson. 482 5¼x7¼-inch pages with 358 illustrations. The Macmillan Company, New York and London. Price, $1.40.

This book is intended more especially for a school text book, but it is equally well adapted to home readers. Considered as a text book, it is a striking commentary on the progress of electricity since the not

recent time when the subject occupied perhaps a fourth of the compass of text books on physics. Large use is made of the analogies between a current of electricity and one of water, and in other respects the explanations are extremely clear and simple. The book is by practiced teachers, is not mathematical and can be confidently recommended to all who desire to begin the study of electricity at the beginning of the subject. In comparison with most technical books the price is very low—a fact which is, we suppose, due to its intended use as a school text book. The binding is in half leather and the mechanical execution is in every way first class.

"The Electrical Catechism." Compiled from the regular issues of *Power*. 210 6x9-inch pages with 246 illustrations. The Hill Publishing Company, New York. Price, $2.

The articles which are here reproduced in book form were intended for central station or isolated plant engineers and to explain the things which such men need to know. Among the subjects discussed are Principles of Dynamo and Motor Construction, Circuits and Wiring, Measuring Instruments and Measurements, Alternating Currents, Generators and Circuits, Transformers, Synchronous, Polyphase and Induction Motors; Rotary Converters; Arc, Incandescent and Nernst Lamps. These subjects will be seen to include much more than generating apparatus, and the book is, in fact, well adapted to the needs of all who wish to inform themselves regarding the action and the properties of the various kinds of electrical machinery. The book as a whole relates to principles rather than to detailed constructions and is an excellent example of simple, direct and clear exposition of essentials.

The Engineer.

'Midst Maxims' click and rattle,
Quick-firers' crack and scream,
Dazed with the lust of battle,
Half blind with smoke and steam,
Men face the flying shrapnel,
And dare the bursting shell,
When every gun's a shambles,
And all the deck a hell!

But pent and caged, unknowing
Which way the fight incline,
I keep my engines going
Beneath the water-line.
No praise or blame to spur me
In this my hour of trial,
I stand and grip the lever,
I stand and watch the dial.

I know no battle-passion
To set my blood aglow,
I work in sober fashion,
But if we fail, I know
That boiled, or flayed, or stifled,
Or mashed amongst the gear,
I die, a "mere non-combatant,"
An unknown Engineer.

—*J. H. K. Adkin, in The Spectator.*

Personal.

Baxter D. Whitney, of Winchendon, Mass., announces that his son, William M. Whitney, has been taken into partnership with him and the firm will hereafter be known as Baxter D. Whitney & Son.

Fritz B. Ernst has been appointed to be instructor in car and locomotive design at Purdue University, from which school he graduated in the class of 1900 in civil engineering. Since graduating he has been a member of the editorial staff of the *Railway Age*, of Chicago.

J. R. McColl has been appointed associate professor in thermodynamics at Purdue University. Prof. McColl is a graduate mechanical engineer of Michigan Agricultural College and has been at the head of the department of mechanical engineering in the University of Tennessee, at Knoxville, during the past ten years.

Obituary.

Charles Howell Wing, superintendent of the shops of the Ryther & Pringle Company, Carthage, N. Y., manufacturers of paper-mill machinery, died August 2, sixty-seven years old.

Mrs. Bridget French, an inventor with a record of thirty-six United States patents, died at Rochester, N. Y., last week, seventy-two years old. Mrs. French was born in Ireland and came to this country in 1850, residing ever since in Rochester.

Commercial Review.

NEW YORK, Monday, August 11.

Judging from statements made during the week, it is evident that the tendency to advance prices is broadening. While formal communications to that effect are not plentiful, conclusive proof is easily obtainable that machinery cannot be purchased now within 5 or 10 per cent. that it could be a short time ago. This statement is not confined to lathes, planers, shapers and drill presses, advances in which came through concerted action recently, but practically to machinery of all kinds.

It is not an unusual thing nowadays to enter a machinery salesroom and to be informed that the price of this or that class of machinery has been advanced. "I don't know where this advancing fever is going to end," said a representative of one of the largest houses in the business, "but every day we hear of some department of the trade that it has reached. Still, with conditions as everybody knows them, there seems to be no other alternative."

In the face of these facts, it would seem an impossibility to record any department of the trade where a different state exists. Yet, unfortunately, this can be done. During the week the writer conversed with representatives in New York of some of the largest wood-working machinery manufacturers, and learned from them certain facts which show that branch of the trade to be in more or less of a sorry plight.

In the first place, it is admitted by all of them that competition has become so keen that wood-working machine tools can be had cheaper to-day than any machine tool that could be mentioned. One manufacturer said his company was getting no more for its product nowadays than it did three years ago. In view of the higher prices of raw material and the increased cost of labor, this is surprising, to say the least. Another stated that he knew of bids being submitted where the difference in some cases was 40 per cent. Another told of being requested to bid on a certain number of wood-working machines. He complied with the request, and quoted figures far below those his company named for the same kind of machines. "Later on," said the writer's informant, "I was called up on the telephone by the party to whom I submitted the bids, and asked by him if I didn't make a mistake in my figures. I told him I did not, whereupon he informed me that a certain company had offered to supply the same machines at a price so low that I have been wondering from that day to this how they could do it. Of one thing I was happy, and that was that my bids were not accepted."

Those interviewed by the writer had no hesitation in saying that these things had a demoralizing effect on the trade. When questioned as to a remedy that would prevent them, the consensus of opinion was that it was time the wood-working machinery manufacturers "got together," to use a colloquial phrase.

An attempt was made in this direction some time ago, the leading spirit in which was a well-known Cincinnati manufacturer. He did not meet with much encouragement, and abandoned the idea. But for the one reason which urged him to assume the task at the time, there are any number of reasons which should impel him to undertake it now. Facts already noted leave no doubt on this point. The proposition may have met with some opposition when it was first broached, but all assurances indicate that the time is ripe for its realization now. "Competition is the life of trade," said one wood-working machinery manufacturer, "but when it takes upon itself ruinous forms, as in our line at present, it's time to put the danger signals out."

What is said to be the largest single contract ever awarded for complete marine electrical equipment has been captured by the New York office of the Thresher Electric Company, of Dayton, Ohio, located at No. 120 Liberty street, and of which Hayden H. Smith is manager. It is for the complete electrical equipment of the battleship "Virginia," now in course of construction at Newport News. The order amounts to $165,000. Among other things it calls for are two 100-kilowatt and six 50-kilowatt generating sets, 125 motors ranging in size from 35 to 1-6 horsepower, six 30-inch hand-controlling projectors, and two signal sets. The eight

engines that go with the generators will be of the cross-compound type and will be furnished by W. D. Forbes & Co., of Hoboken, N. J.

Fairbanks, Morse & Co., of Chicago, Ill., manufacturers of steam pumps, gas and oil engines, etc., have opened an office and salesroom at No. 133 Liberty street this city. Heretofore its business in the East has been handled by sales agents, but they now feel that the extension it has recently undergone needs their personal attention.

According to the Chief of the Bureau of Statistics, an increase of 10 millions in imports of iron and steel manufactures and a decrease of 19 millions in the exports of that class of articles, is the most striking characteristic of the commerce of the year just ended. The total imports of iron and steel manufactures in the fiscal year just ended were $27,180,255 in value against $17,874,789 in the preceding year, while the exports of iron and steel manufactures were $68,552,562, against $117,319,320 in the preceding year. This makes the imports of the year larger than those of any preceding year since 1893.

One of the principal causes of the low prices in foreign markets seems likely to terminate in the near future. These reductions in prices were, it is stated on good authority, due in part to excessive exportations of iron and steel manufactures from Germany, made at unusually low prices with the purpose of disposing of an accumulated surplus caused by overproduction and the reduced home demand due to the recent temporary depression existing in the industries of that country. This surplus having been largely disposed of and the depression having apparently passed its most acute stage, it is believed that the exports of iron and steel from Germany will soon resume normal conditions, both as to quantity and prices, and that with this, one of the important causes of the reduction in prices of iron and steel manufactures in the foreign markets will disappear and normal conditions in our own export trade be resumed.

The Fitchburg Steam Engine Company, of Fitchburg, Mass., has received the following orders: One 450 horse-power tandem compound engine, from the John Stevenson Car Works, Elizabeth, N. J.; one 750 horse-power cross-compound railway type engine, from the Elmira Water, Light and Railroad Company, Elmira, N. Y.; one 125 horse-power engine, from the Rossie Velvet Company, Mystic, Conn.; one 100 horse-power engine, from the Manhattan Silk Company, Ogdensburgh, N. Y. The sales were made at the New York office of the company, at No. 39 Cortlandt street, of which Edwin H. Ludeman is manager.

Dun's Review reports that there were two failures during July, in iron, foundries, and nails, with liabilities of $20,000, and eleven in machinery and tools, with liabilities of $88,667.

J. E. McClintock, the New York representative of the Oil City Boiler Works, Oil City, Pa., has received orders for a dozen internal furnace boilers, of the marine type, for installation in several large buildings now in course of construction in this city. These kind of boilers have come in for increased attention in this vicinity recently.

E. P. Reichelm & Co., of No. 23 John street, have received an order for a complete gas fuel plant, for installation in the works of the Gorham Manufacturing Company, at Providence, R. I.

The contract for the two vertical 770 horse-power engines for installation in the Portsmouth Navy Yard at Portsmouth, N. H., has been awarded to the Buckeye Engine Company, of Salem, Ohio, through its New York representative, Paul Bigelow, at No. 39 Cortlandt street.

The Water Department of this city is experiencing considerable trouble in connection with the bids for the establishment of a pumping station at Baldwins, L. I. After being advertised three times, the bids were opened on August 8, with new difficulties making their appearance. The bids of Henry R. Worthington, the Holly Manufacturing Company and the Snow Steam Pump Company, were rejected because they did not contain checks for the customary 10 per cent. deposit demanded by the city charter. Williams & Grestle, of New York, filed a protest against the contract being awarded at all, on the ground that the specifications regarding the boilers made it possible for only a certain Boston firm to compete, and that the specifications in general were too stringent. Mr. T. Davidson, of New York, submitted the only bid for the complete plant, and it was for $67,800. The only other bids received, outside of the one noted and the three rejected, came from A. S. Granger, of New York, for the two boilers, and was for $11,950. The entire matter has been referred to the Corporation Counsel for adjustment, and the probability is that the advertisement will be inserted for the fourth time.

Eben S. Draper, of Hopedale, Mass., has returned from England, whither he went a short time ago as the representative of the Northrop Loom Company of America. While in England he organized the British Northrop Loom Company, Limited, with a capital of $750,000, all of which has been subscribed, according to Mr. Draper, and which will commence the manufacture of Northrop looms in Manchester about November 1 of this year.

John Fostre Fraser, an English journalist, whose labors have taken him all over the world, and who perhaps is best known as the author of "The Real Siberia," arrived in this country a few days ago, to make a study of the conditions of American workmen. He has already traveled in thirty countries making an investigation of the labor conditions in each.

"Your country certainly has a splendid future opening up in the Far East," said he. "Everywhere I have been I saw American manufactures, locomotives, bridges, machinery and other products. I believe that Siberia will be the great agricultural country of the future. It reminded me of your own great West, the Wyoming section particularly. I saw plenty of American agricultural machinery there. The government buys it and sells it to the peasants at cost or in instalments."

Dr. D. Mayer, who has been United States Consul at Buenos Ayres, Argentine Republic, for the past five years, is now on a brief visit to this country. He speaks very highly of the progress American machinery is making in that country. He says that the superior workmanship and finish of it have become so well recognized that at least 75 per cent. of all machinery imported there comes from American manufacturers.

Makers of electrical machinery with foreign connections are in receipt of letters informing them that there is an immense amount of the same in stock in Germany, and that it is being disposed of generally at cost price, and frequently below it. That German manufacturers of electrical machinery have been greatly disappointed in their trade expectations is demonstrated by the annual report recently issued by the Schuckert Company, probably the largest electrical manufacturing plant in Germany. The net earnings of the company for 1902 show a loss of nearly $2,225,000.

Inquiries for castings from Chicago and Western points are reaching Eastern foundries in large numbers nowadays. One foundryman refused a Chicago order of over 100 tons of castings, recently, because he had all he could do to meet Eastern demands. The order was for farm implement castings, a department of trade Western foundries are finding very brisk at present.

The Crocker-Wheeler Company, of Ampere, N. J., is finding increasing demand for its various lines of direct-current machinery, and is making provision for large increases of floor space. A new building now half way to the roof will nearly double the present capacity, and by clearing out many small machines in the main shop permit of the placing of new and heavier machinery to accommodate larger sized generators and more rapid work on large orders for the smaller standard machines. The new building is of brick, slow burning mill construction, three stories in hight, and intended for the winding departments and light machine tools. A portion of the basement space will be used for the experimental laboratories whence emanate the changes in design of Crocker-Wheeler apparatus for embodying their features.

Mr. J. P. O'Donnell, the head of the International Pneumatic Tool Company, of London, England, is in America, arranging the final details of the transfer of that company to the Chicago Pneumatic Tool Company. Taking over this company

gives the latter control of the pneumatic tool trade throughout Europe. They will now consolidate the factory of the International Pneumatic Tool Company with their plant already started in London and are sending men from their staff in America to take charge of the office and factories in London. They have been compelled to operate two of their plants in America extra time, working at night, and this addition to their London plant will give them a much needed increase in manufacturing facilities, as well as giving them the control of the pneumatic tool business here. Mr. J. W. Duntley, president of the company, will sail for London, August 12, to arrange matters to vigorously push the trade in Great Britain and on European continent. At the present time the company have a force of experts in Glasgow, Scotland, giving an exhibition of ship riveting and ship construction with pneumatic tools under the auspices of the Glasgow Federation of Shipbuilders. They realize the imperative necessity of the use of pneumatic tools in that work to enable them to compete with American shipbuilders and it is anticipated that practically all of the yards on the Clyde will very shortly be equipped with pneumatic tools. The company look for some good orders for the latter.

CHICAGO MACHINERY MARKET

Country machine shops are now ordering supplies with great freedom. Monkey wrenches, oil cans and scores of other accessories are moving briskly. The threshing season is at hand and repairs to farming machinery are everywhere in progress. Regular shopwork also is flatteringly active. A salesman, who has just returned from a trip throughout the West and Northwest, says that everywhere he found the machine shops busy, many of them running overtime, sometimes twenty or twenty-two hours per day. It has been this way pretty much all summer; but where there had to be idleness because of needed repairs or other causes resumption has been hurried and shops generally are again in full operation. Hence the volume of business in shop supplies is slightly better than a month ago. There has been some recession from spring business, but not equal to the ordinary slump and the reason therefor, as intimated above, is the universal activities of shops.

Closely related to this brisk call for supplies is the demand for machinists. It is a common complaint among manufacturers that while unskilled labor is usually ample skilled mechanics are in great demand. In most of the smaller manufacturing towns in the West both men and residences are scarce. Building has not kept pace with the increase of shop facilities. Especially is this true of those towns whose industries are not greatly diversified, a large shop addition calling for enough additional men to bring dwellling houses to a quick and marked premium. This perhaps helps to explain the recent spurt which is noted for tools in the building trades, construction work being vigorous at all growing towns and cities. Quite a number of machine shops have this season removed from congested centers of population to suburbs or to distant hamlets. The labor question with them becomes peculiarly acute.

For such supplies as are used in planing mills and other wood-working establishments the Pacific coast is said to be developing a large and important market, because of the rapidly growing lumber interests. Locally at Chicago the market seems less active than country business, but this is believed to be because the competition here is so much the keener.

The Northampton Emery Wheel Company reports that business this summer has been phenomenally good. The Machinists' Supply Company makes a similar statement of business conditions. C. H. Besly says there is no quiet season this year. His company expects to erect a new Chicago store and warehouse this fall. The whole line of machinists' tools and supplies seems to be in excellent request.

Quotations.

NEW YORK, Monday, August 11.

The pig-iron market continues to be marked by good inquiry for material deliverable next year, even though one large producer announces itself out of the market for the first six months. Melters who have this year's wants to supply are relying on foreign irons to help them out. New York prices for this year, largely nominal, are as follows:

Northern:	
No. 1 X	$23 50 @ $25 00
No. 2 X	22 75 @ 23 50
No. 2 plain	22 25 @ 22 50
Southern:	
No. 1 Foundry	22 00 @ 23 00
No. 2 Foundry	21 75 @ 22 50
No. 3 Foundry	21 25 @ 22 75
No. 4 Foundry	20 25 @ 21 25

Bar Iron—Base Sizes—Refined brands, mill price on dock, 1.93c. upward in carload lots. Smaller quantities from store, 2.15 @ 2.20c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 11⅞ @ 12c.; electrolytic and casting, 11¾ @ 12c.

Pig Tin—In 5- and 10-ton lots, f. o. b. New York, 28⅝ @ 29c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—5⅜ @ 5½c.

Antimony—Cookson's, 10 @ 10¼c.; Hallett's and U. S., 7¾ @ 8c.

Lard Oil—Prime City, 82 @ 85c., according to brand and quantity ranging from one barrel up to large lots.

New Corporations.

Timken Roller Bearing Axle Co.; principal office, 76 Montgomery street, Jersey City, N. J.; object, manufacturing anti-friction bearings; capital, $500,000. Incorporators: H. H. Timken, W. R. Timken, L. M. Preston and Chas. Hardenburg.

United States Foundry & Sales Co.; principal office, The Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing machinery, etc.; capital, $150,000. Incorporators: Horace S. Gould, John I. Billings and Louis B. Dailey.

The International Moffett Bearing Co. has been organized at Kittery, Me., to carry on the business of electrical engineers. President, Wm. H. Beardsley, of New York city; treasurer, Horace Mitchell, of Kittery. The Continental Moffett Railway Bearing Co. has also been organized at Kittery.

Manufacturers.

F. J. Goodspeed, Wilton, Me., has let the contract for an additional woolen mill.

The Oswego (N. Y.) Knitting Company has ordered machinery to triple its capacity.

The Richmond Stove Company, Norwich, Conn., is enlarging its foundry facilities.

Binkley Bros.' foundry, sawmill and shingle mill at Neustadt, Ont., has been burned.

Plans have been made for a new plant for the Michaelman Boiler Company, Quincy, Ill.

The Warren Bituminous Waterproof Pavement Company is building a plant in Harrisburg, Pa.

New thread mills will be built for J. L. & T. D. Peck Manufacturing Company, Pittsfield, Mass.

H. M. Williams & Co., manufacturers of plated wire, Attleboro, Mass., are building a new factory.

The contract has been let for the erection of a building for the Corona Knitting Mills, Anderson, S. C.

A Philadelphia building permit has been taken out for a factory for F. W. Tunnell, glue manufacturer.

The Buckeye Stave Company, having its headquarters at Leipsic, O., will erect a hoop factory at Fostoria.

The Lake Erie Iron Company, manufacturer of nuts and bolts, Cleveland, O., will erect a new factory.

A three-story factory, 78x115 feet, is to be built in Chicago for George F. Moore, manufacturer of moldings.

The Otis Elevator Company, New York city, has purchased property in Chicago as the site of a new plant.

The Columbus (O.) Iron & Steel Company has bought 37½ acres of land and will add extensively to its plant.

The Bellevue washery, owned by the Delaware, Lackawanna & Western Company, has been burned; loss $35,000.

An addition is about to be built to a power-house of the Pennsylvania Railroad Company in Philadelphia, Pa.

A two-story factory building is about being erected for the Celluloid Company, Newark, N. J.; estimated cost, $12,000.

The Hope Webbing Company, Pawtucket, R. I., desires to erect a building which will practically double its capacity.

S. P. Shoup & Son, Shelbyville, Ill., are about to build a plant at Danville to manufacture store, office and banking fixtures.

The Huber Manufacturing Company, Marion, O., manufacturer of farm engines, threshers, rakes and scrapers, will extend its plant.

It is announced from Rangeley, Me., that the birch mill of A. S. True, on Sandy River pond, has been burned, most of the machinery being lost.

Armour & Co. and Swift & Co. will erect a joint machine shop in North Fort Worth, Tex., to take care of the work of the two big packing plants.

Plans have been filed for a 48x112½-foot addition to the factory of George W. Lord, manufacturer of boiler compound and oils, Philadelphia, Pa.

A contract for building a factory for the Martin Velvet Company, of Taftville, Conn., has been awarded the H. Wales Lines Company, of Meriden.

A new factory is to be built in Philadelphia for the Adams & Westlake Company, manufacturer of railroad supplies, etc., of Chicago and that city.

Major C. B. Heffelfinger has a project to erect a $165,000 building for light manufacturing in Minneapolis, Minn., at Fourth street and First avenue north.

The electric light company at Derry, N. H., is making arrangements to enlarge its plant and will place a Rollins 450 horse-power compound engine in the same.

The contract for the foundation work for the new factory building to be erected by the Johnson Electric Service Company, Milwaukee, Wis., has been awarded.

It is announced from North Tonawanda, N. Y., that the contract has been awarded for the construction of the Tonawanda Board & Paper Company's plant on Goose Island.

John M. Dubrow, inventor of a gas burner and mantel, will manufacture the device in Columbus, O., where, it is said, he has received encouragement from local business men.

Plans are being completed for rebuilding the two sections of Armour & Co.'s lard refinery at the stockyards, Chicago, destroyed by fire some time ago. The structure will cost $150,000.

F. C. Avery, M. C. Alford and F. M. Shaw have been appointed to file incorporation papers of the Fort Collins (Colo.) Sugar Manufacturing Company. An independent plant may be erected.

B. H. Bryant, of Colorado Springs, general superintendent of the Colorado Midland, with John I. Franklin and several other gentlemen, are interested in the proposed erection of a steel plant at Colorado City.

The Chartiers Valley Water Company proposes to build a pumping station on the Monongahela about 30 miles above Pittsburgh. The improvements are estimated to cost $5,000,000.

The United States Pump Company's proposed plant (see page 1066), which may be located at Industrial Heights, a suburb of Toledo, O., will include a fine foundry equipped with modern machinery.

The Stoner Wall Paper Manufacturing Company, Chicago, Ill., has suffered damage to its factory by fire, the conveyers which carry the paper over the steam dryers being about half wrecked and the roll machines a total loss.

The Kirby Lumber Company, Houston, Tex., has in view to build several more mills. Theo. S. Wilkin, manager, has been in Milwaukee to see about buying $100,000 worth of sawmill machinery for some of the company's plants.

The Lewis Roofing Company, Moline, Ill., is building a plant in a Chicago suburb and will move there. The Lewis Fire Proofing Company is establishing a plant in Rock Island to make cement tile and asbestos fire proofing.

Stone quarry and sand property near Sylvania, O., is now in process of development. Upwards of $300,000 will be expended. The Edward Ford and the Libbey glass interests at Toledo are understood to have some connection with the work.

The Western Car & Foundry Company is having plans prepared for an addition to its plant at Hegewisch, Ill. There will be several buildings of steel construction, to be used in the manufacture of steel cars. The improvement will cost $150,000.

R. A. Alley, of New Zealand, representing the Australian Woolen Company, has been in negotiation with the Tacoma (Wash.) Chamber of Commerce relative to the establishment there of a woolen mill. The project seems to have been favorably received.

The Imperial Tobacco Company of England and Ireland, which a few months ago began business in this country, has purchased the factory of James N. Boyd & Co., Richmond, Va., with considerable adjacent land, and is expected to erect a large factory.

A company is being formed to establish a copper smelter at Sherbrooke, Que. It may be called the Eastern Townships Mining & Smelting Company. Among those interested in the project are Geo. Smith, of Thetford Mines, and J. R. Woodward, of Sherbrooke.

Philipp Goerres, 1819 Vliet street, Milwaukee, Wis., will erect a large new cooper shop. The main building will be 178x50 feet. The power will be furnished by a 125 horse-power engine. The factory will have a capacity for turning out 500 barrels a day at the start.

The Indiana Rolling Mill Company has been incorporated; capital, $300,000. A mill will be built at Newcastle, Ind., much of the material and machinery being already arranged for. C. W. Mouch, whom we understand to be a Newcastle man, is a prime mover.

Articles of incorporation for the Lincoln Cotton Mill have been filed. The capital stock is $300,000. It is practically settled that the company will erect its plant at Evansville, Ind. The following are the directors: Stephen A. Jenks, James J. Hooker, Charles N. Brown, Asa B. Morgan and Stanley A. Hooker.

The Safety Emery Wheel Company, Springfield, O., is preparing to enlarge its plant, near Lagonda, by the erection of a machine shop, 60x140 feet, and also two additions to the present factory. One of the additions will be used for mold, store and powdered emery rooms, the other addition as a dry and kiln room.

The contracts for the new plant of the Cleveland Pneumatic Tool Company have been awarded to Messrs. J. A. Reaugh & Son, of Cleveland, O. It is expected to have the plant completed and ready for operation within ninety days. The plant will be equipped with the most modern machinery and appliances.

The S. Obermayer Company has been having plans drawn for an additional factory building, 60x90 feet, at its Cincinnati plant. It is expected to have the building finished and the factory in operation inside of a few weeks. It will be equipped with new machinery, some of which has already been contracted for.

Architect Norval Wardrop, for the Lloyd Construction Company, Detroit, Mich., is preparing plans for a gas manufacturing plant for the Citizens' Railway & Lighting Company, of Muscatine, Ia. There will be a group of brick buildings for retort, condenser, exhauster, purifier and meter purposes. All the machinery will be supplied by the Lloyd Construction Company.

It is reported that the Merrimack Manufacturing Company, of Lowell, Mass., has decided to erect a second cotton mill of 25,000 spindles, to be operated in connection with its first mill at Huntsville, Ala.; also that the original plans of the company provide for the erection of eight mills of 25,000 spindles each with a large bleachery.

H. O. Havemeyer, C. J. Welsh and others are said to be interested in a new Cape Cruiz Construction Company, the object of which is to grow sugar on an extensive scale in Cuba. The company, it is said, will acquire 17,000 acres of land near Manzanillo and erect a factory to cost $800,000, with capacity of 20,000 tons of sugar yearly.

Thomas A. Edison's improved process of manufacturing cement was put to practical use the other day when active operations were begun in the Edison Portland Cement Company's large new plant at New Village, near Stewartsville, Pa. Mr. Edison and directors and stockholders of the new company were present when the machinery was started.

Letson & Burpee, of Vancouver, B. C., and Fairhaven, Wash., have bought land at Seattle for a machine shop and foundry. A contract has been let by W. D. Perkins for the construction of shops at the same place, and land has been purchased by Hon. J. M. Frink, president of the Washington Iron Works Company, as a possible site for a new plant of that company. In the same region also new warehouses are being erected by the Puget Sound Machinery Depot.

The Water Motor & Power Company, incorporated under the laws of Delaware with a capital stock of $1,000,000, will erect a power plant at Great Falls, on the Virginia side of the Potomac, about eighteen miles above Washington. The company will supply power to manufacturing plants now in operation or in contemplation and expects to furnish enough power to supply practically all of the Washington industries, including street car lines and electric-lighting plants.

A company has been formed in Terre Haute, Ind., with a capital of $50,000, for the purpose of manufacturing sulphuric acid from pyrites. It is known as the Indiana Pyrites Company. A mill will be built in a short time either in Terre Haute, Clinton or Fontanet. One thousand tons of pyrites will be cleaned a week. Practically the same business is being carried on at Terre Haute by R. W. Prescott, the president of the company, at the present time, and about 250 tons of pyrites are cleaned a week.

At the annual meeting of the Peck, Stow & Wilcox Company, Southington, Conn., manufacturer of tools and general hardware, the announcement of the declaration of a regular 2-per-cent. quarterly dividend and of a special 3-per-cent. dividend was made. The company operates plants in several cities and recently has added to its Cleveland business the Brittain & Matthew Lock Works, of Pittsburg. It is stated that the business of the Southington factory will be considerably expanded this year and that new lines of manufacture will be added.

Articles of incorporation have been filed in Michigan for the National-Fulton Brass Manufacturing Company, of Detroit. It is a reorganization of the Fulton Iron & Engine Works, of Detroit, which have been in existence for fifty years. Under the reorganization its capital stock is increased from $200,000 to $400,000. George H. Russel becomes president, M. T. Conklin, first vice-president; J. F. Harrgan, second vice-president, and F. E. Beal, secretary. The new company besides largely increasing the facilities for output of its Detroit plant has already perfected plans for new works at St. Louis.

The New York Central proposes to establish

a great electrical system to bring its trains into New York and carry on suburban traffic. The third rail system will be used for local traffic, and through trains will be brought in from Croton by electric locomotives. A big union station for suburban passengers will be built in the Bronx. It remains to get the Legislature's approval for the project. If carried out, nearly $20,000,000 will be spent, it is said. There will be several power-houses, furnishing 100,000 each. Plans, it is said, are in the hands of the company. It is hoped to begin work next fall and have the system running in two years.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 18.

Punches & Dies. Wal.M.Wks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book, "Dies and Diemaking," 100 6x9 pages, $1, post paid ; send for index. J. L. Lucas, Bridgeport, Conn.

Purchaser for an established manufacturing business, including patterns and tools ; it is suitable for any first-class machine shop. Address No. 20, care AMERICAN MACHINIST.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings ; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

For Sale—Eighteen paid shares of stock in machine shop incorporated at $10,000 ; good position for man who can take charge. Box 753, AMERICAN MACHINIST.

Grinding beats filing ; try us on either hardened or soft work, capacity 7 in. diameter, 48 in. long, and under. The Garvin Machine Co., Spring and Varick sts., New York.

Gear and milling cutters, adjustable reamers and special tools ; vertical millers, cutter and surface grinder and shears, catalog of small tools free. R. M. Clough, Tolland, Ct.

Wanted—Several second-hand screw machines with friction back gear ; No. 6 Brown & Sharpe or No. 4 Pratt & Whitney preferred. Address, giving full particulars and price, Allen Fire Dept. Supply Co., Box 33, Providence, R. I.

Wanted to buy, complete machine, newest construction, to manufacture wooden blocks for shoe-nailing machines. Send lowest offers with explanations or directions of this machine to L. 941, Haasenstein & Vogler, Breslau, Germany.

Purchaser for small manufacturing plant in Madison, Wis. ; lot, 100x180 feet ; machine shop, 32x68, two story, with line shaft and gasoline power ; foundry, 40x54, new modern equipment ; good location ; for sale cheap. Hart-Parr Co., Charles City, Iowa.

Owing to the death of one of the active members of a machine and foundry business (incorporated for $100,000)the present management wish to find a man with a thorough knowledge of the business, that would take hold with energy and invest some capital ; this is a rare opportunity for the right man ; paper and pulp mill machinery a specialty. Address M. & F., care AMER. MACHINIST.

For Sale—Half interest or entire plant, consisting of machine shop, foundry, pattern shop, large stock of patterns and boiler shop, in one of the largest Southern cities ; well equipped for every class of work and now engaged on a large amount of profitable contract, repair and special work ; location near center of city on main lines of several railroads ; climate perfect. Address Box 755, AMERICAN MACHINIST.

For Sale—1 50 in. x 36 in. x 20 ft. planer, 2 400-light dynamos, 1 14x36 in. Hamilton Corliss engine, 1 9x12 in. Chandler & Taylor slide valve engine, 1 9x10 in. Chandler & Taylor automatic engine, 1 direct-connected steam air compressor, 12x12, Ingersoll-Sergeant ; 1 10-ton, with 3-ton auxiliary, Chisholm & Moore air crane, 30 ft. span ; 1 jib crane, 10 tons. All of the above can be seen in operation at Henry Vogt Machine Co., Louisville, Ky.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine ; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R. ; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery ; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

By a practical, experienced man, charge of fine manufacturing. Box 742, AMER. MACH.

Mechanical draftsman with practical shop experience desires position. Box 715, A. M.

Mechanical draftsman with experence wishes position. Box 761, AMER. MACHINIST.

Position of responsibility, by competent machine shop or toolroom foreman. Box 754, AMERICAN MACHINIST.

First-class mechanical draftsman wants position ; New York or Brooklyn. Box 762, AMERICAN MACHINIST.

Open for engagement, machine shop foreman of broad experience ; energetic and reliable. Box 719, AMERICAN MACHINIST.

Designing draftsman with extensive experience on special machinery and tools for manufacturing purposes. Box 752, AMER. MACH.

Brass foundry foreman desires a position ; familiar with Tabor pneumatic molding machines ; first-class reference. Box 751, A. M.

Superintendent desires responsible position with reliable firm where ability will be appreciated ; steady, sober and hard worker. Box 759, AMERICAN MACHINIST.

Young machinist, with technical education, wishes to obtain position with engineering company, or as assistant to master mechanic. Box 757, AMERICAN MACHINIST.

Practical mechanical draftsman, with shop experience and technical education, is open for engagement ; first-class references ; age 30. Address R. L. F., care AMER. MACHINIST.

Wanted—Responsible position, not in drafting room, by graduate, 31, now with steel company, and experienced as draftsman and foreman. Box 743, AMERICAN MACHINIST.

Technical graduate in engineering, with 3 years' experience, desires position with reliable concern ; experimental work preferred, in part at least. Address Box 758, AM. M.

A first-class toolmaker, with much inventive ability, wants position as designer and experimenter to improve machines, increase, output, etc. ; A1 references. T., care AM. M.

Position as foreman of screw machine or turret department ; 10 years' experience as foreman of hand and automatic screw machines and turret lathes. Address Box 756, AMERICAN MACHINIST.

Patternmaker foreman, 33 years, wants permanent situation in Pa. or N. J. ; experienced in machine, tool, architectural and general jobbing work ; A1 references. J. D. H., 3048 N. Carlisle st., Philadelphia.

Pattern shop foreman desires a position ; first-class, practical man, not afraid to work ; experienced on engine, mining, sawmill and general machinery ; at present located in vicinity of Chicago. Box 749, AM. MACH.

Young man, 30 years, wants position as foreman of machine shop in agricultural works ; experienced in blacksmith, pattern work ; has up-to-date ideas ; capable of getting work out quickly. Box 764, AM. MACHINIST.

Practical superintendent ; 25 years' experience on machine and tool work ; superintendent of large, high-grade typewriter factory for 7 years ; age 45 ; good organizer ; understands cost-accounting, etc. ; references. Box 750, AMERICAN MACHINIST.

Mechanical engineer, Swiss, 29 years old, graduated M. E. by European polytechnical institute, extensive experience in pump and engine work and air compressors, wishes permanent position ; successfully original. Box 760, AMERICAN MACHINIST.

Mechanical engineer and draftsman wishes to change in September ; technical education ; large experience as foreman, master mechanic and superintendent manufacturing small and medium interchangeable machinery and fine steel instruments. Box 712, A. M.

Help Wanted.

Wanted.—First-class patternmakers wanted at Reeves Engine Co., Trenton, N. J.

Wanted—First-class rifle and shot-gun stocker ; steady work for proper man. Remington Arms Company, Ilion, N. Y.

Wanted—A first-class wood pattern maker ; ten hours day ; wages 30c. per hour. Address Wm. E. Hill & Co., Kalamazoo, Mich.

Mechanic, thoroughly experienced in toolroom work. Address, with full particulars, Niagara Machine & Tool Works, Buffalo, N. Y.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—A first-class high-speed engine designer and draftsman ; state wages expected and give references. Reeves Engine Co., Trenton, N. J.

Wanted—By the Morris County Machine & Iron Co., Dover, N. J., two first-class machinists, accustomed to accurate lathe and planer work.

Wanted—First-class lathe and machine hands at The Reeves Engine Company, Trenton, N. J. Steady work and good wages to first-class men.

Wanted—Ten good patternmakers at once ; new shop and equipments ; good wages. The Balkwill Pattern Works, 970 Hamilton st., Cleveland, Ohio.

Wanted—A first-class draftsman and machine designer with technical training and experience ; location in Boston. Box 745, AMERICAN MACHINIST.

Wanted—First-class mechanical draftsman, experienced on direct-current motors ; state experience and salary expected. Box 763, AMERICAN MACHINIST.

We want several first-class floor hands, fitters and scrapers on machine tool work ; also a few good lathe hands. De Laval Steam Turbine Co., Trenton, N. J.

Wanted—Good mechanical draftsman in New England States ; write age, education, experience and salary expected. Address Box 736, AMERICAN MACHINIST.

Wanted—Several A1 draftsmen ; give experience, reference and salary expected. Engineer in Charge, Drafting Department, General Electric Co., Schenectady, N. Y.

Wanted—A mechanical draftsman with experience on machine tools and special machinery ; state wages expected. "Worcester County," care AMERICAN MACHINIST.

Wanted—Lathe and planer hands for night work on heavy machine tool work ; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—Immediately, additional general machinists, also automatic screw machine operators ; good wages and steady work. The National-Acme Mfg. Co., Cleveland, Ohio.

Wanted—A competent erecting engineer ; one familiar with the erection of high-speed engines ; a competent, sober man. Address "High Speed," care AMERICAN MACHINIST.

Wanted—Inspector with wide experience on light, interchangeable parts, similar to watches and typewriters. Address, with references, Box 747, AMERICAN MACHINIST.

Wanted—An active and reliable young draftsman on highest class small machinery ; position made agreeable. Address, with full particulars, Pike, 528 N. Vandeventer ave., St. Louis, Mo.

Wanted—Good foundry foreman to take charge of 75 to 100 molders ; well versed in foundry practice, mixing of metals, etc. ; state age, experience, references. The Goulds Mfg. Co., Seneca Falls, N. Y.

Wanted—First-class toolmakers, experienced on punch and die work ; must also be first-class men on general work ; state experience, also wages expected. Richmond Electric Company, Richmond, Va.

Wanted—Foreman for drilling department, large manufacturing concern ; one accustomed to handling help, and knowledge of latest practice. Address, with references, Box 746, AMERICAN MACHINIST.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists ; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—Representatives in several of the leading cities to sell, on commission, high-grade automatic engines ; modern designs ; none but thoroughly experienced salesmen need apply. Address "Engine Builder," care AMERICAN MACHINIST.

Wanted—A man between 25 and 30 years of age, who has served his time in a ma-

chine shop and had a good scientific education, to take charge of a small shop running on high-class work in connection with a prosperous business. Box 729, AMER. MACH.

Designing draftsman wanted; an experienced mechanical draftsman on general engineering, accustomed to producing complete specifications with designs; applicants will state previous experience, salary expected, age and references; good prospects for a suitable man. Address Box 748, AMER. MACH.

Wanted.—Machinists, toolmakers, draftsmen, do you want to increase your salary? They all say that Saunders' enlarged edition "Hand Book Practical Mechanics" exactly fills the bill for valuable shop kinks, rules, etc., figured out by simple arithmetic and drawings; also most competent reference tables in existence, many taken from note books of best mechanics in the country. Pocket size. Price, post paid, only $1, cloth; $1.25 leather. Agents wanted. Book sells itself. Big money. C. H. Saunders, 216 Purchase st., Boston, Mass.

Manager Wanted.—An engineer and business man who has actually and successfully handled the business, correspondence, sales and salesmen of a large engineering and manufacturing company or industry is wanted for similar work by a firm on the Atlantic coast; a technical knowledge of general engineering is a necessity in the work. Also great executive capacity and energy in handling the office business and the salesmen; those who have not had the experience to fill the position need not apply; a suitable applicant may expect a careful consideration of his communication in reply to this advertisement. Box 744, AMERICAN MACHINIST.

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Arbor Press

Barnes Co., W. F. & John, Rockford, Ill.
Bartlett, E. E., Boston, Mass.

Balls, Steel

Federal Mfg. Co., Cleveland, O.
Grant Tool Works, Franklin, Pa.

Ball Bearings

See Roller Bearings.

Bars, Boring

Cleveland Twist Drill Co., Cleveland, O.
Underwood & Co., H. B., Philadelphia, Pa.

Barrels, Steel

Cleveland Wire Spring Co., Cleveland, O.

Bearing Metal

Phosphor Bronze Smelting Co., Philadelphia, Pa.

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Dixon Crucible Co., Jos., Jersey City, N. J.
Houghton & Co., E. F., Philadelphia, Pa.

Belt Lacing Machines
Diamond Drill & Mach. Co., Birdsboro, Pa.

Belting, Leather
Shultz Belting Co., St. Louis, Mo.

Bending Machines, Hydraulic
Bement, Miles & Co., New York.
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Bending Machines, Power
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
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See Hoists, Hand.

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Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.

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Struthers, Wells & Co., Warren, Pa.

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Baird & Co., Henry Carey, Philadelphia, Pa.
Henley & Co., N. W., New York.

Boring and Turning Mills
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Castings, Die Molded
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Pratt Chuck Co., Frankfort, N. Y.
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Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutting off Tools
Armstrong Bros Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
Toledo Machine & Tool Co., Toledo, O.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Drafting Machine
Universal Drafting Mach. Co., Cleveland, O.

Drawing Boards and Tables
Rich, J. & G., Philadelphia, Pa.

Drawing Instruments
Altenedor & Son, Theo., Phila., Pa.
Keuffel & Esser Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Aurora Tool Wks., Aurora, Ind.
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Sphingfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Gang Co., Wm. E., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haveh, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrically-Driven Tools.
Clark, Jr., & Co., Jas., Louisville, Ky.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Backus Water Motor Co., Newark, N. J.
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Struthers, Wells & Co., Warren, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Eye Shield
McDougal, W. H., Charleston, W. Va.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.
Troy File Works, Troy, N. Y.

Filing Machines
Cochrane-Bly Mach. Co., Rochester, N. Y.
Rotary File & Mach Co., Brooklyn, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wk., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
N. Y. Gear Wks., Brooklyn, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Center
Browning Mfg. Co., Milwaukee, Wis.
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Modern Tool Co., Erie, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Safety Emery Wheel Co., Springfield, Ohio.
Tanite Co., Stroudsburg, Pa.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Tanite Co., Stroudsburg, Pa.

Grindstones
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Toledo Mach. & Tool Co., Toledo, Ohio.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathe Feed
National Mach. & Tool Co., Cincinnati, O.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Co., Wm., Cincin., O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fairbanks Mch. Tool Co., Springfield, O.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Tanite Co., Stroudsburg, Pa.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Prov., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Stow Mfg. Co., Binghamton, N. Y.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Gobeille Pattern Co., Cleveland, O.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Straley, Hasbrouck & Schloeder, New York.

Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Planers
American Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Presses, Hand
Elmes Engr. Works, Chas. F., Chicago, Ill.

Presses, Hydraulic
Bement, Miles & Co., New York.
Elmes Engr. Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.
Toledo Mach. & Tool Co., Toledo, Ohio.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Elmes Engr. Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting,
Cooke Machinery Co., New York.
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
State College of Kentucky, Lexington, Ky.
Purdue University, Lafayette, Ind.
Worcester Polytechnic Institute, Worcester, Mass.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Gump & Co., A. W., Dayton, O.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.
York Mchry. Co., S. M., Cleveland, O.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Barker & Co., Wm., Cincin., O.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Smith & Mills, Cincinnati, O.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.
Toledo Machine & Tool Co., Toledo, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Federal Mfg. Co., Cleveland, O.

Steel, Machinery
Hermann Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Federal Mfg. Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriache & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Foster, Walter H., New York.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Unions, Brass
Nolte Brass Co., Springfield, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Holland Mfg. Co., Erie, Pa.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Prentiss Vise Co., New York.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Prentiss Vise Co., New York.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Guarding Machinery Against Accidents.

The proper guarding of the various points of danger about the machine shop, such as the gearing on lathes, drill presses and other tools, driving belts, rapidly rotating flywheels, etc., is a subject that has received, from the majority of American firms at least, hardly the attention to which it is entitled. Anyone familiar with manufacturing plants can readily recall numerous instances where workmen have been more or less seriously injured through being caught in some machine part which might easily have been covered, thus making it practically impossible for an accident to happen at that point.

It is a well-known fact that workmen constantly employed about machinery become indifferent to danger and are oftentimes injured through their own carelessness. In view of this fact it is a question if it is not the duty of employers to guard their machines wherever possible.

This matter seems to have been given more careful consideration abroad; in fact, the thorough manner in which machinery is guarded in many of the shops there is, to the American visitor, a feature of considerable interest. As a result of European requirements in this line, many of the machines now turned out by our tool builders are well supplied with guards.

We believe our readers will be interested in learning of some of the measures taken by a well-known American firm to prevent accidents in its shops. J. H. Williams & Co., the drop forgers, of Brooklyn, for a number of years have been fitting guards to various machines about their works, and in the accompanying half-tones several of these machines, of different types, with their respective guards, are illustrated.

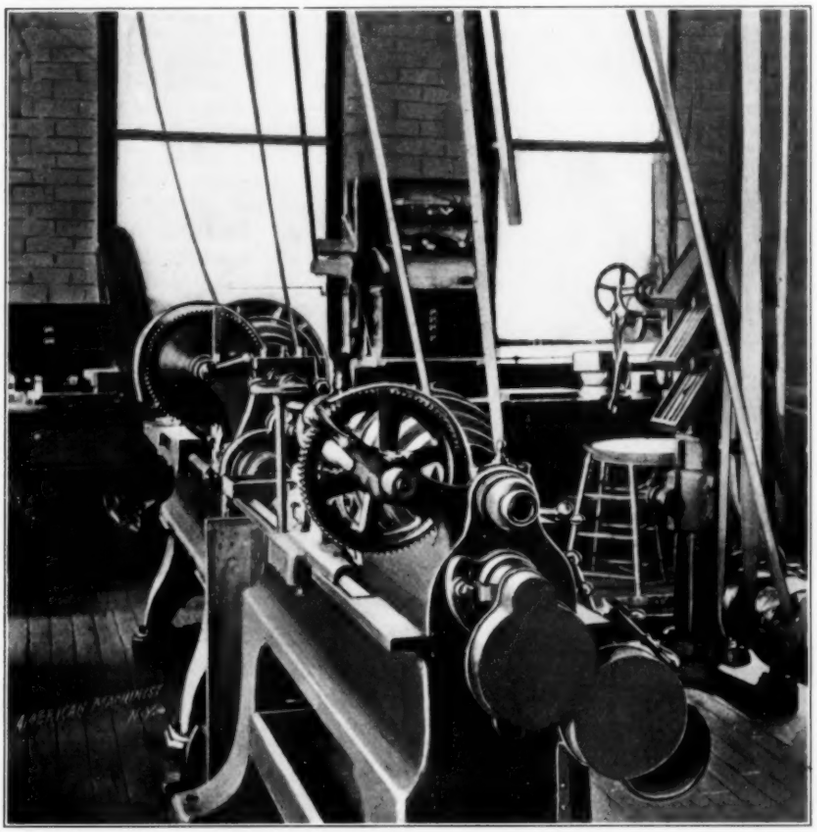

FIG. 1. LATHE GEAR GUARDS.

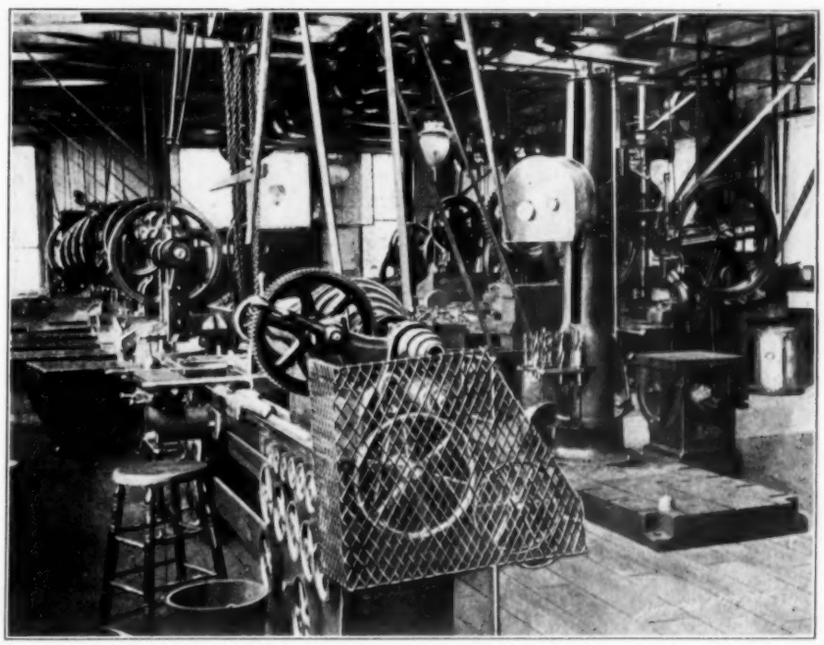

FIG. 2. LATHE GEAR GUARDS.

Figs. 1 and 2 show two methods of enclosing lathe change gears. The gear case in Fig. 1 is made of thin sheet metal and is held in place by screws tapped into the lathe bed. The lathes in this view have also narrow steel guards over the back gears. The guard over the gears at the end of the lathe shown in Fig. 2 is made of heavy wire netting and is attached to the back of the bed in such a manner that it can be swung around out of the way when the gears are to be changed. The guard over the gearing at the back of the radial drill, which is shown in this illustration, can be opened to allow the mechanism inside to be oiled.

Fig. 3 shows the manner in which guards are arranged for the belts and pulleys on such machines as drill presses and shapers. The frames which carry the wire work are fastened to the floor, the uprights being provided with lugs which are drilled out for wood screws.

Fig. 4 shows a heavy punch press fitted with a sheet metal guard for the gearing and with wire guards for the driving belt and flywheel. In Fig. 5, which is a view in the drop-forge shop, is shown the overhead wire network for catching splinters and large pieces which may fly from the drop boards. There are several trimming presses in this department—one of these with its guard of wire netting being shown in the foreground.

The illustrations show but a small part of such work that has been done in these shops. Iron guards have been put overhead to catch belts that would be in danger of winding up were they to drop on the line shaft, and, wherever possible, square-head set-screws have been removed from the shafting collars and replaced by headless screws. Where it has

been necessary to retain the square-head screws wooden guard rings have been put on the collars. These rings, or collars, are made in halves and a hole is drilled at the inside of one of the pieces so that it will fit over the projecting head of the screw. The two pieces are fastened together by screws and form a perfectly smooth ring which can be readily removed when necessary to adjust the collar. The engine driving the works is provided with a safety stop which can be operated by push-buttons located at various points about the place. Pipe rails have been put up around the driving gears of some of their planers, and where a number of drill presses are placed in a row, pipe rails have been run along at the back of the belts. In several instances the bevel gears driving drill press spindles are enclosed in neat sheet metal cases, and gears and pulleys on various milling machines about the place are enclosed in wirework or sheet steel guards. There are in their several departments numerous other interesting examples of machines equipped with efficient guards; enough illustrations have been given, however, to indicate the manner in which this work has been taken up.

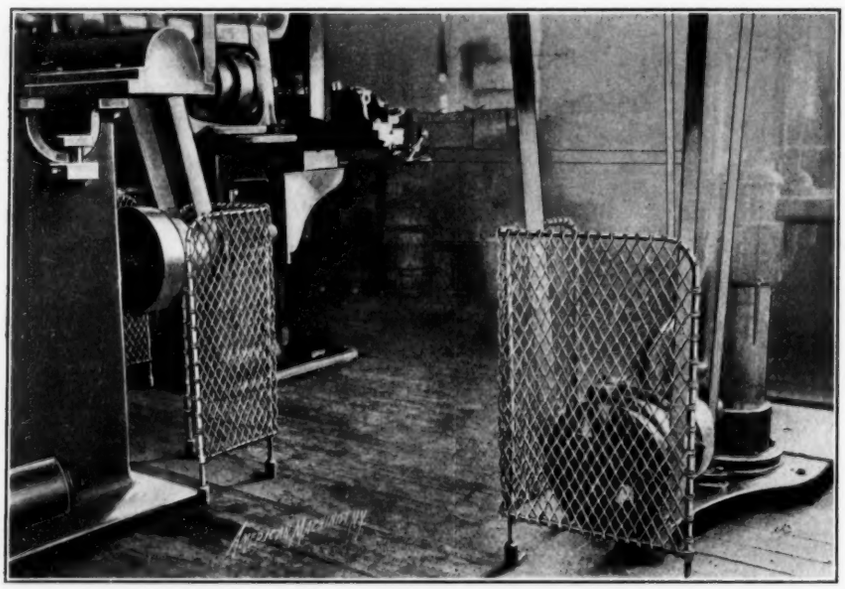

FIG. 3. GUARDS FOR SHAPER AND DRILL PRESS.

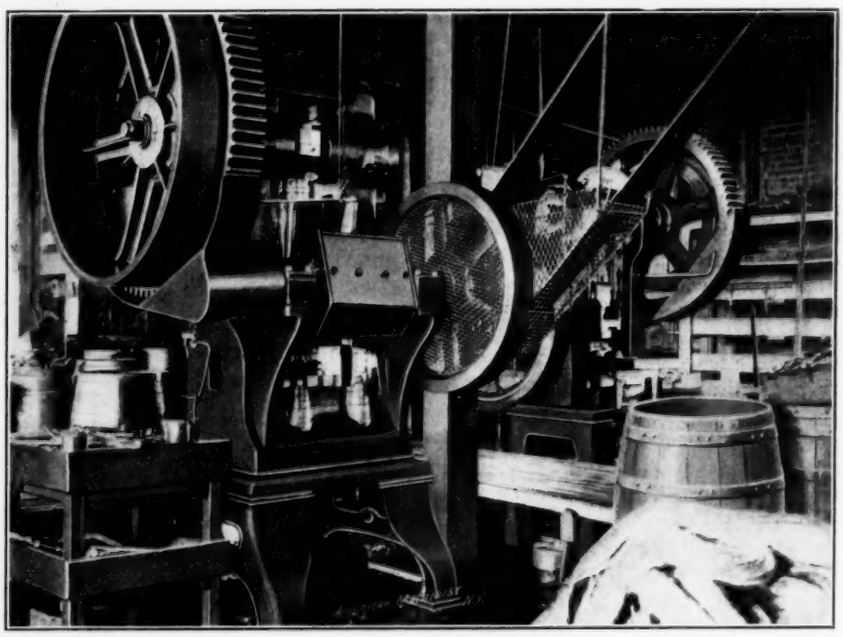

FIG. 4. PUNCH PRESS GUARDS.

The Economic Value of Technical Education.*

The day of the untrained man is past; the day of the technically trained man is here. At no time have the untrained, the unfit, the poorly prepared been so ruthlessly weeded out of the professions, the arts, the trades and business callings as they are to-day. The incessant demand, heard by him who has "his ear on the ground," is for young men in the vigor of manhood, whose eyes, ears and hands, as well as minds, are trained to do the work demanded in modern industrial pursuits. Those who stand midway between the active industrial workers on the one hand and the oncoming groups of younng men on the other, like the administrative officers and professors of our technical schools, are able to take a broader and more comprehensive view of the field of supply and demand than most others.

Most, if not all, recent improvements in educational methods in this country have been purely academic or philosophic; they have been evolved by musing in the library or perhaps from class-room experience; but none of them have resulted from a close acquaintance with the real conditions of the industrial and business warfare into which the student enters when he leaves the school. The so-called "systematical development" given to young people is but a twentieth-century way of training a "jack-of-all-trades." The one thing needful will not come from teachers' conferences, nor county institutes, nor the august meetings of school superintendents, for the attendants at these assemblages have not, and cannot get from their experience, the proper point of view. The great majority of the public-school teachers are women whose environment has been limited by the home, the school and some social functions. The number of men engaged in teaching who have done serious practical work outside of the school-room is small. The academic circle which they tread reminds one of the Illinois farmer whose circle of experience was to raise more corn to feed more hogs, to buy more land—to raise more corn to feed more hogs, to buy more land—*ad infinitum.* Educators of to-day should break out of the circle in which they are traveling and look at matters from a new point of view. This should be from the vantage ground of the factory, the workshop, the railroad or the counting-room; it should be industrial and commercial rather than academic. The practicals needs of every-day workers should be considered, after a scientific study of conditions at present existing. There should be no prejudgment by the social or educational philosopher who knows not the difference between a "shaper" and a "milling machine," and evolves theories of what ought to be but never is.

Mere practice, no matter how long continued, cannot long avail against theory followed by intelligent application. A stupid fireman can burn up the profits of his establishment by ignorant firing; an engine man was recently discovered running an engine for no other purpose than to get exhaust steam to heat his building. He was a "practical man of long experi-

*From a paper by Victor C. Alderson, Dean of Armour Institute of Technology, in the *Journal of the Western Society of Engineers.*

ence." A soap manufacturer who had depended upon the "knack" of one workman for many years nearly went into bankruptcy when the man died, for no one else seemed to have the requisite "knack"; but the employment of a trained chemist without the "knack" regained for him his lost business. A large railroad company recently saved more than half a million dollars in six months by equipping a laboratory in connection with its machine shops and putting in charge a technically trained man—one who could unite theory with common sense.

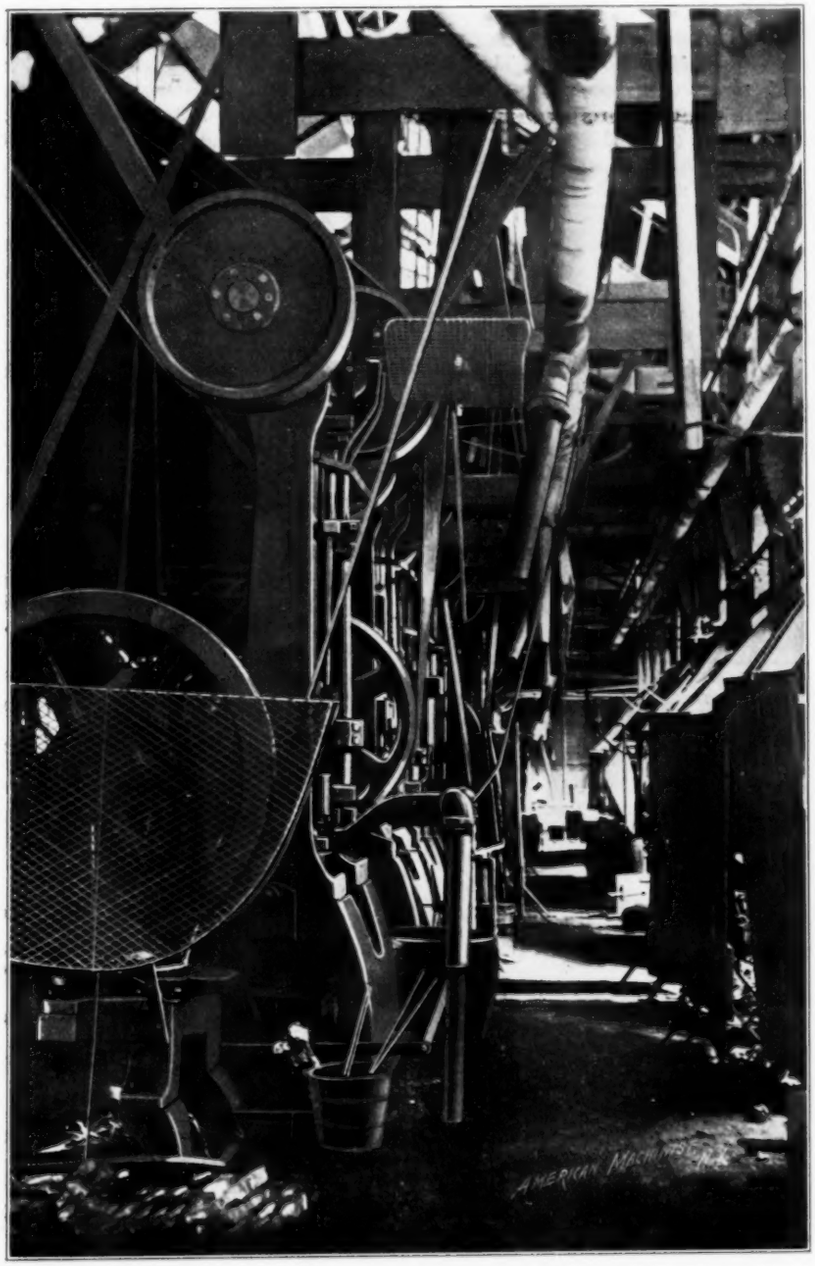

FIG. 5. GUARDS IN FORGE SHOP.

Switzerland is best known to Americans as a region of mountain scenery, but it is an object lesson for us in a manner not yet fully recognized. The natural conditions under which the Swiss people have struggled for the past six hundred years have been so burdensome and their industrial success is so pronounced that Switzerland is to-day the best of the European countries in which to study the close relation which exists between the technical education of the masses of the people and national industrial prosperity. There are fewer people in all Switzerland than in Greater New York; the largest city—Zurich—contains only 150,000 persons; the area of the country equals the combined area of but three of our smallest States—Massachusetts, Connecticut and Rhode Island; of this area 29 per cent. is utterly unproductive even for the frugal Swiss; 21 per cent. is forest; 25 per cent. is meadow and grazing land; 13 per cent. under fruit; 12 per cent. is under crops and gardens; the country has no seaport, no navigable river, and no lake of commercial size; she has little or no natural wealth; she must import her raw materials, work them up into salable form and export them; lines of transportation are expensive and rates high; the amount of fertile soil is meager, and would scarcely make a respectable-sized Western ranch. In the United States we have been allowed to blunder at will, to be improvident and wasteful; we cut down our forests with reckless disregard for the future. Twenty-six years ago Switzerland enacted a law that her forest area should never be reduced, and since that time for every tree that has been cut down another has been planted. Forced by almost cruel natural limitations to rigid economy, both of material and labor, required to solve the problem of industrial success under exacting requirements, Switzerland has given us a solution which it behooves us to examine with considerable care. That solution is the careful, systematic education of each citizen—be his station in life high or low—so that his efforts will be efficient enough to meet competition in similar lines of work the world over.

Swiss education is the result of no single philosophy, no one method, no selfish utilitarian object; it has not been dominated by social reformers nor by mere theorists; it is a composite type, the result of many conflicting views and necessities. Throughout the entire system can be seen, however, an attempt to solve the problem of the relation between education and industrial prosperity. This point of view is the one thing needful in developing our own system of technical education, and the one idea which we can best borrow from the Swiss. With them no valuable feature—either cultural or technical—is ignored. Each brand of knowledge is prized according to its value as discipline or as a distinct aid in professional or industrial pursuits. Their object is not only to train men and women for their vocations, but to build up new industries or at least to extend and strengthen those already established. They have even enriched the humblest callings with many applications of art, skill or science; they have expended money liberally upon every form of technical education which would increase the workingman's efficiency; they have transformed regions naturally poor and barren into thriving communities; they have entered freely into international competition, and have made the world their marketplace; they have shown that technical education is an economic necessity, worth many times its cost. The commercial and industrial success of Switzerland, achieved in the face of great natural obstacles, shows conclusively that the surest foundation for industrial prosperity lies in a complete and thorough-going system of technical education.

Improved Variable Speed Countershaft.

At page 414 we described the variable-speed countershaft made by the Lodge & Shipley Machine Tool Company, of Cincinnati, Ohio. This device has been remodeled lately and improved in a number of ways. Our readers will remember that when changing speeds in the earlier countershaft the lower or driven shaft, with its connecting cone and key, was moved along step by step through the gears, by means of a shipper which had at its upper end a fork that dropped into grooves cut around the shaft. The shipper was also used to release a friction clutch on the driving shaft above, thus allowing the driving gears to slow down during the speed-changing operation. In the new arrangement the cone and key on the lower shaft can be moved quickly from one end to the other, and the shaft is driven at a constant slow speed, while the change is being made. The half-tone, Fig. 1, gives a good idea of the improved countershaft, and the line engravings, Figs. 2, 3 and 4 show its construction.

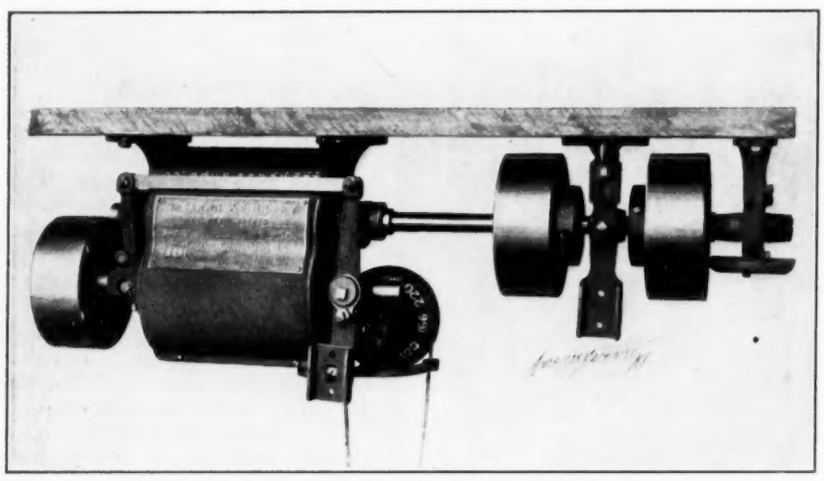

FIG. 1. IMPROVED VARIABLE SPEED COUNTERSHAFT.

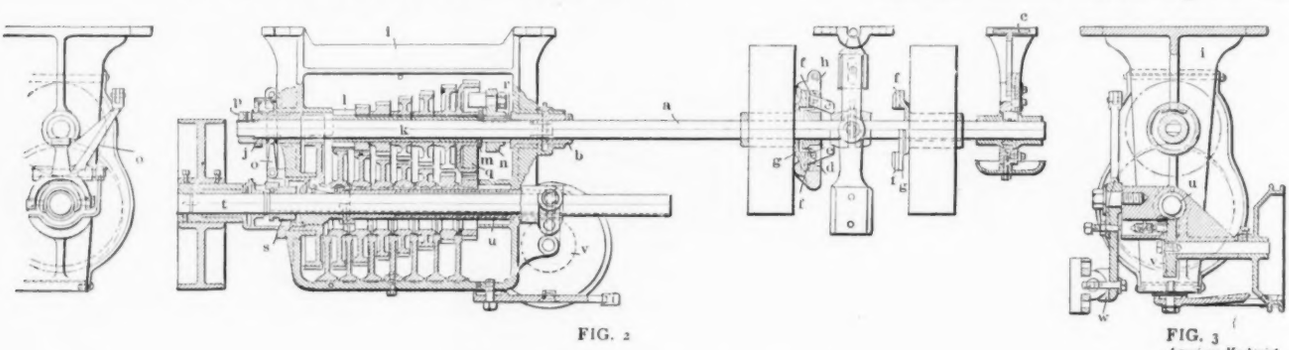

FIG. 2

FIG. 3
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IMPROVED VARIABLE SPEED COUNTERSHAFT.

In Fig. 2, *a* is the driving shaft with one end running in a self-oiling box in hanger *c* and the other end carried in the sleeve *b* in the right-hand side of frame *i*. This U-shaped frame is provided with self-oiling bearings for sleeve *b* and also for sleeve *j* at the left-hand side. Shaft *a* is pinned to sleeve *b*, to prevent end movement. It is milled out at the left-hand end to correspond with the clutch on the sliding pinion shaft *k*. Mounted loosely on shaft *k* is a pinion *l*, which has a long sleeve passing through the larger gears of this cone. These gears are keyed to the sleeve pinion and form practically a gear cone, which is at times independent of the rotation of shaft *k*, the reasons for which will be explained later. On the shaft *k*, which rotates at all times in unison with shaft *a*, is formed a pinion, shown at the right of the bushing *j*, and on the end of the shaft is secured a collar *p*. The bushing *j* is slotted on its lower side to receive the upper end of the rocker *o* and when this rocker is operated both bushing and shaft are moved endwise. The flange *n* at the right, keyed and clamped to move with shaft *k* between the largest gear and the frame, is provided with a wedge which is held in place by the nut, as shown. The taper of this wedge fits a corresponding taper in the split friction ring *q* in the gear. A washer *m* is placed on the shaft to serve as a retainer for friction *q*, and between the washer and the sleeve *b* are vertical pins *r*—passing loosely through flange *n*—which prevent the gears from moving endwise. It will be seen that when the shaft is moved by the bushing *j* and rocker *o*, the cone of gears will be locked to it or unlocked by the friction ring *q*.

The largest lower gear meshes at all times with the pinion of shaft *k* and has a hub which takes its bearing in the bore of the boss on the lower left-hand end of frame *i*. This hub is provided with a friction which is operated by the wedge collar *s* splined to the shaft *t*. The collar is moved on the shaft by the rocker *o*, this rocker having a fork at its lower end provided with a shoe fitting a groove in the collar. All of the lower gears are bored out much larger than the shaft *t* and are provided with keyways. The bore of these gears is the same as the outside diameter of the sliding cone, which lifts the gears into mesh with their drivers. This cone is provided with a spring key and is moved along through the gears by the sliding sleeve *u*, the latter having on its under side a rack which engages with the gear *v*. The gears that are not in mesh rest in the forks which are bolted to the bottom of the frame, the arrangement here being practically the same as in the earlier design. The inside of each gear is beveled at the same angle as the outside of the cone and the keyways are so located that when the cone is shifted from one gear to another the new gear shall be fully engaged and the old one entirely disengaged before the spring key can get into a keyway and so lock the driven gear to the shaft.

The gear *v* which operates the sliding cone is keyed to the short shaft shown in Fig. 3. On the right-hand end of this shaft a rope sheave is secured. A rope guard is bolted to the bottom of the frame and carries a pointer which extends to figures cast on the beveled edge of the sheave, these figures denoting the speeds given by the gears. The gear *v* has as many radial grooves milled in its face as there are gears on the lower shaft, and a spring-seated plug in front of the gear carries a roller which engages these grooves. To the left of this plug is another plug made slightly conical to bear against the pointed screw shown in the lever *w*. This lever is connected at its upper end with rocker *o* by a flat connecting rod shown in Fig. 1. A shipper is bolted into the pocket shown at the lower end of lever *w*, and extends down to the operator. This shipper, when moved to the right, releases the friction in the large gear of the lower shaft and locks the upper gears to shaft *k*, and when moved to the

left the upper cone of gears is released and the lower gear is locked to its shaft. Thus the power is removed from the upper gear cone, and the lower shaft driven slowly during the speed-changing operation; for the shipper must be moved to the left before the rope sheave can be turned.

Referring again to Fig. 3, it will be seen that the pointed screw in lever *w* bears against the point on the spring-seated plug

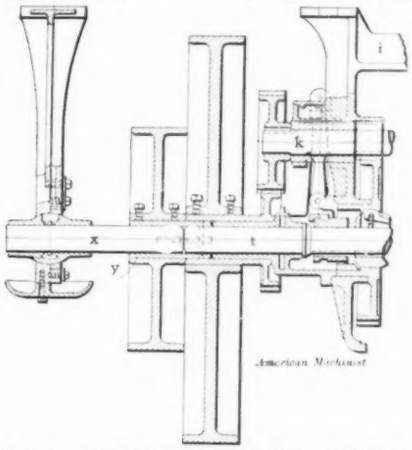

FIG. 4. COUNTERSHAFT ARRANGED FOR DRIVING A PLANER.

when the upper cone of gears is locked to shaft *k*. At this time the inner surfaces of the two plugs are in contact and the roller has not sufficient lateral movement to get out of the groove in gear *v*, but when the shipper is moved to the left, thus releasing the upper gears, and locking the large gear below to its shaft, the pointed screw moves out of line with the point on the spring plug and the sheave may then be rotated to any desired position. But should it be rotated so as to bring the lower sliding cone between two of the gears, the spring-seated plug will be forced out sufficiently to lock the lever *w* in such a position that the upper gears cannot be locked to shaft *k*. This device makes it possible to run the countershaft at a very high rate of speed without danger of breaking the gears when the speed is being changed.

The friction pulleys which drive the shaft *a* are arranged in an altogether different manner from those on the countershaft previously illustrated. The friction here is designed with a view to using standard stock pulleys, the friction plate *g* having a long hub which is turned up to fit the bore in the pulley hub. The plate *d*, which is secured by set-screws to shaft *a*, has two slots through which pass levers *e*. Half-round grooves are milled on either side of the slots and at right angles to them, and form bearings for the pins which are driven into the levers *e*. The cast-iron shoes *f*, which are slotted to fit the ends of the levers, bear against the plate *g*. The counterbored split ring *h* is threaded to fit the outside diameter of plate *d*, and the seat formed in the ring bears against the back side of the plate *g*. The split ring *h* is adjusted to the desired position and clamped in place. The usual form of sliding, double-tapered cone is mounted on the shaft between the frictions, and when this cone is moved between the fingers *e* they are swung outward and force the shoes *f* against plate *g*, thus clamping it between them and the seat in split ring *h*. Two frictions are provided for backward and forward motion, but with this design any number of frictions may be added and any size pulleys used without causing any serious alteration.

Fig. 4 shows the manner in which the countershaft is arranged for a planer drive with a constant speed reverse. A gear is mounted on the end of shaft *k* in place of the collar *p*, and this gear meshes with a sleeve gear which runs on the lower bearing and drives the larger backing pulley. The shaft *t* has an extension *x* connected to it by the sleeve coupling *y* and fits the bore of the forward motion pulley. As the shaft *k* has a constant speed so will the large pulley have a constant speed, as it is not influenced by the action of the lower shaft *t*; but as the smaller pulley is fastened directly to the lower shaft, its speed is controlled by the gears within the frame *z*.

A committee of the union of German toolmakers has petitioned for a competent authority to settle patent disputes; in this they agree with the congress for trade rights which met at Cologne in May, 1901, at which a special court for the settlement of patent disputes was spoken of as a necessity.—*The Engineer.*

The Administration of the Premium Plan at the Works of The Bickford Drill and Tool Company.

The shop administration system of The Bickford Drill and Tool Company possesses many points of interest and such of these as relate to the premium plan will be described in this article.

Figs. 1 and 2 show respectively the front and rear sides of a form which performs many functions, the first of which is that of a shop or production order. When an order for a given number of machines is to be sent into the shop the cost clerk fills out the upper left-hand corner of the front side, Fig. 1, a ticket being made out for each piece of a complete machine. As thus made out, the ticket goes to the stock clerk, who, in accordance with the instructions at the bottom of the rear side, Fig. 2, looks over his stock to see if he has the necessary material on hand. If so, he fills out this side of the form and sends it to the general foreman. If not, he orders the material and retains the form until it arrives, when he sends the form to the general foreman, its receipt by the general foreman being a notification that the material is on hand ready for work. At the same time, to record for his own use the fact that a given lot of castings is "engaged," the stock clerk fills out a tag, Fig. 3, and wires it to one of the pieces, this tag remaining with the lot until it goes to the assembling floor, when it is sent to the time clerk. The general foreman has a series of pigeon holes in his desk, one for each of the different classes of work and the form as received is placed in the pigeon-hole for the work to be done on the piece as a first operation—that is, if the first operation is lathe work, the form goes into the lathe work pigeon-hole, while if the first operation is planing, it goes into the corresponding pigeon-hole. The blanks in any pigeon-hole that show the general foreman at any time how much untouched work of the corresponding class he has ahead of him. When ready to begin work on the piece the form is sent back to the stock clerk by a laborer, who obtains the material and delivers it to the workman designated by the general foreman. When the material is delivered to the shop the stock clerk sends the form to the time clerk, the delivery of the form

LOT ORDER No. 4739

Shop No. ..... Pcs. ..... Sym. .....

OPERATIONS	WORKMEN'S NAMES	No.	COMMENCED Mo.	COMMENCED Dy.	COMMENCED Hour	FINISHED Mo.	FINISHED Dy.	FINISHED Hour	TIME Regr.	TIME Over

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FIG. 1. CAPTION OF FRONT SIDE OF SHOP ORDER, COST SHEET AND MATERIAL CARD. ACTUAL SIZE 5x8 INCHES.

being a notification to the time clerk that work on the lot of pieces is about to begin. The time clerk places the form in its serial order in a box file similar to a card file and from this on the form becomes a record of the work done on the piece, the entries being made on the front side, Fig. 1. The box at any one time contains of course, a form for every piece in progress in the works.

these tickets, giving in the third line the lot order of the work stopped and in the fifth line the lot order of the work taken up, at the same time noting in the last line whether the work stopped was finished or merely interrupted by a more pressing piece of work. At the close of the day each foreman sends his day's product of these tickets to the time clerk.

It will be noted that the workman makes out no time ticket whatever. Mr. Norris regards this as a matter of fundamental importance when premium work is being done, and to insure that each workman shall inform his foreman of the approaching completion of a piece of work in ample time to permit him to get another ready, it is a rule of the shop that any loss of time between jobs shall be charged to the last one finished—the time entered on Fig.

MATERIAL ISSUED FROM STORES.

SYMBOL	DESCRIPTION OF MATERIAL	DATE	QUANTITY		AMOUNT

Remarks: .....

Material .....

Wages .....

Prime Cost .....

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READ CAREFULLY:—Upon the receipt of this order from the Drawing Office, the Stock Clerk will first note if he has in stock the fu'l quantity of material called for on the reverse side of this blank. If on hand, he will fill out and attach a tag to one of the pieces, and will then send the order immediately to the General Foreman; otherwise he will make requisition at once for such material as is required to complete the lot, and will hold the order until the same is delivered into his care.

When the order reaches the General Foreman it will be pigeon-holed according to the class of tool by which the first operation will be performed, and will be retained by him until such time as he wishes to assign the work, when the order will be handed to a laborer with instructions to present it to the Stock Clerk, and to deliver such materials he shall receive from him to the workman to whom the work has been allotted.

The Stock Clerk will give out no material other than called for by one of these blanks or a Stock Withdrawal Order, countersigned by the foreman, one or the other of which forms will be filled out by him as indicated above, and sent immediately to the Cost Clerk whenever anything is removed from stores.

FIG. 2. REAR SIDE OF SHOP ORDER, COST SHEET AND MATERIAL CARD. ACTUAL SIZE 5x8 INCHES.

The information required by the time clerk for making these entries comes to him on the form shown in Fig. 4, of which each foreman has a padded supply in his pocket. Whenever a foreman gives a workman a new job, he fills out one of

LOT No. _____

SHOP No. _____

No. PIECES _____

SYMBOL _____

DRAWING _____

NAME _____

_____

_____

READ NOTICE ON REVERSE SIDE

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FIG. 3. STOCK CLERK'S TAG FOR INDICATING THAT MATERIAL IS ENGAGED. SHIPPING TAG SIZE.

Mr. _____ No. _____

STOPPED WORK ON

Lot Order No. _____ at _____ o'ck.

To _____

The Work Called for on Ticked No. _____

Finished _____ Unfinished _____

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FIG. 4. TIME CLERK'S NOTIFICATION TICKET. SHOWN FULL SIZE.

PREMIUM TICKET, SHOWING EARNINGS OF

Mr. ..... No. ..... Tool No. .....

On .....

..... Pieces Marked ..... For Piece Order No. .....

TIME	HRS.	DATE		REMARKS
Commenced				
Finished				
Time Limit		RATE	EARNINGS	
Actual Time				
Premium				
Labor Cost of Work				
Labor Cost per Piece				
Inspected				
By		Foreman		Read Notice on Reverse Side.

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FIG. 5. PREMIUM TICKET. ACTUAL SIZE 4x6 INCHES.

4 being in all cases the time when a new piece of work is taken up, this entry serving in all cases, regardless of delays, for the entry showing when the last piece of work was stopped.

It will be observed also that ambiguity in the time tickets is avoided, as the time is reported by the lot order number, and, moreover, this number is taken from the lot order itself. Ambiguity is, perhaps, possible in connection with the name of the operation, but it should be remembered that the foremen fill out the Fig. 4 tickets and it is comparatively easy to train a few foremen to use correct language, while it would be difficult to train a shopful of men, as would be necessary if the men made out the tickets.

Assuming that there has been no interruption to the previous job, the receipt of a Fig. 4 ticket by the time clerk gives him the necessary information for making an entry in the "Commenced" column of one Fig. 1 sheet and in the "Finished" column of another. As the work progresses, entries are made for the various operations and when the final operation on a lot of pieces is finished the sheet is totaled up and removed from the file of work in progress, the totals for the various operations being then entered in a card file for preservation. The time clerk is informed of the final completion of a lot of pieces by the receipt of the tag, Fig. 3. In case a given lot has been interrupted, the time clerk has the Fig. 4 tickets showing the facts and these are consulted before making the entries in Fig. 1.

In filling out Fig. 1 the time clerk has the time clock records before him and he consults these in order to prevent charging up time when the workman has been absent or late. He will, for example, be advised by means of a Fig. 4 ticket that work was commenced on a certain job at 8 o'clock one morning and in due time another Fig. 4 ticket informs him that this piece of work was completed at 4 o'clock two days later. If the time clock records show that the workman has lost no time in the interim, the clerk charges up all the intervening time, but should the clock record show the workman to have been late or absent, a corresponding correction is made.

On the completion of a piece of premium work a premium ticket, Fig. 5, is made out in duplicate on tickets of different color, the duplicate copy being made by carbon paper. One of these tickets goes to the workman in his pay envelope with the amount shown to have been earned, while the other is retained.

Fig. 6 shows a form which Mr. Norris considers of great value, though not a necessary link in the system. Whenever the time for doing a piece of work has come in, it is, as already stated, entered in a card file kept for that purpose and at the same time is compared with the previous records on the same card. Should the time for the job be excessive, the time clerk fills out one of the Fig. 6 forms and sends it to the foreman in charge, who is expected to look the matter up at once. The operation of this feature will be seen to be almost automatic and the fact that such a ticket is sure to follow any slow piece of work acts of course as a powerful incentive against unnecessary delay.

MR. _____

YOUR ATTENTION IS CALLED TO THE FOLLOWING WORK

_____ SPENT _____ HRS.

IN _____

_____ PCS. MARKED _____ S. No. _____

AS COMPARED TO OUR PREVIOUS RECORDS OF

_____ HOURS _____ HOURS _____ HOURS

_____

TIME CLERK.

American Machinist

FIG. 6. A TICKET WHICH NO ONE LIKES TO SEE. SHOWN FULL SIZE.

The Stock Withdrawal Order mentioned at the bottom of Fig. 2 refers of course to an order for bolts, nuts, etc., as well as for small parts which are manufactured in considerable numbers and not for individual lots of machines. This form is not shown, as it has no special relation to the subject under discussion.

Trade Openings Abroad.

VEHICLE-MAKING MACHINERY FOR GERMANY—SHOE MACHINES—PRACTICAL POINTS ABOUT THE GERMAN TARIFF—CAST-IRON TUBES FOR BRAZIL.

A demand has sprung up of late years in Germany for American-made hubs, spokes, felloes, and bent-wood materials generally, although vehicles manufactured in the United States are not popular. Now, it is found that machines are wanted for fitting the various parts together, and consequently the Germans are open to buy American machines for carriage and wagon making.

I learn, too, that your shoe machinery is in steady demand among the Teutons. But apparently the output of most of this machinery is governed by a syndicate, and my remarks are rather intended for the benefit of makers outside such combine who could, I am assured, do a good trade through miscellaneous dealers throughout the German Empire. As regards the tariff, I am enabled to give your readers some special information received from German merchants. Shoe-making machines should be declared simply "Iron Machinery," which entitles it to enter at a rate of 3 marks, or 71 cents, per 100 kilograms. In machinery where the majority of material is steel or wrought iron, the rate of duty is 5 marks, or $1.19 per 100 kilograms. These are the main points to be remembered. Have it invoiced as "Iron Machinery" and the duty will then be either 3 marks or 5 marks per 100 kilograms, according to the material of greatest percentage in its construction. In the German tariff, machinery is scheduled for duty according to the material of greatest value used in its construction. Polishing, nickel-plating, high finishing of all kinds adds to the dutiable value of machinery imported into the Empire. The general rate which covers a large majority of all agricultural, washing, wagon-making machinery, etc., is 8 marks per 100 kilograms.

A good deal has been written about that *bogey*—the new suggested German tariff. If the proposition now under discussion passes into law, it will take effect at the beginning of 1904. There will be (if it is carried out) an advance on the above-quoted rates. For instance, on sewing machines the duty is advanced from 24 to 35 marks per 100 kilograms. Dynamos and other electrical machinery will range from 6 to 9 marks per 100 kilos., according to size and finish. But I am informed on the best authority that in no case does the bill as it now stands place any prohibitive duty upon machinery. Whether the new tariff will be enacted at all or not, no one as yet knows quite definitely. Probably some kind of tariff will be, but the disagreement on the present measure is so radical and determined that no one knows in what form it will finally be enacted.

Judging from the trade returns of the German export business in machinery, it does not seem to have been in a very flourishing condition last year, as compared with 1900, this being more pronounced in the locomotive and motor trade with Russia, and in the electrical and milling machinery and steam engines exported to France, Russia and Belgium. The demand for electrical machinery in England is responsible for better business between the two countries in that line.

By the way, I learn that cast-iron tubing is very much in demand in San Paulo, Brazil. For instance, the government

asked for tenders some time back for tubes for certain towns, and five firms competed. The Companhia Mechanica Importadora offered American tubes and quoted 1,032,000 milreis (1 milreis equals a fraction over 24 cents); the Lupton Company offered English goods, quoting 1,125,867½ milreis; Zerrenner, Bülow & Co. offered English tubes at 1,057,620 milreis; Lyon & Co. offered European goods at 964,000½ milreis; Gaspar Ricardo & Co., English tubes at 1,092,410 milreis. Lyon & Co. have contracted to supply 2,600 tons of these tubes to measure 3, 4, 6 and 8 inches diameter. I understand they are getting them from a Belgian manufactory, and the government appears to be satisfied with the tubes, so far. F. C. C.

London.

A Punch and Die for End Finishing, Cutting Off and Bending Sheet Metal From the Strip Without Waste—Two Dies for Metal Corner Fasteners.

BY JOSEPH V. WOODWORTH.

Up at the left in Fig. 1 is shown, somewhat enlarged, the piece made by the punch and die, Figs. 1 and 2. These articles are manufactured by the million and are used as protective seals for wooden boxes and cases, their use preventing the usual loss from theft while cases and boxes of goods are in transit. They were produced in one operation, without waste, from 1-32 inch thick cold rolled stock of the required width, and the efficiency of the punch can be appreciated from the fact that it produced 215,000 of the articles shown without grinding.

Fig. 1 is a plan of the punch, a section of both punch and die and a plan of the die without the stripping arrangements, while Fig. 2 is an end view of the tools with the stripper and the inclined fork for operating it in position. The punch consists of the usual cast-iron holder and tool-steel punch. The punch is finished at one end to act as the cutting-off and end-finishing punch, and in the center as the bending die, the half-circular groove in the top being let in for clearance for the stripper pin (see Fig. 2). The punch is hardened and drawn to a dark straw temper.

The die consists of a flat cast-iron bolster into which the cutting-off and end-finishing die and the bending punch are located in dovetailed channels and fastened by flat head screws let in from the bottom of the bolster. The adjustable stop plate also is fastened to the bolster. The stripper and gage combined consists of a piece of ¼-inch stock with a channel cut down through one side wide enough to allow the stock to be fed through it easily, but without side play. It is fastened to the face of the cutting-off die by four round-head screws, as shown in the plan. As shown in the section of the die, the bending punch has a half-round groove let into the face to correspond with the other half in the bending die portion of the cutting-off punch. The cutting-off die and the bending punch are hardened and drawn to a light straw, after which the sides of the bending punch are eased off a bit towards the bottom, so that the metal, when bent, will cling to it instead of to

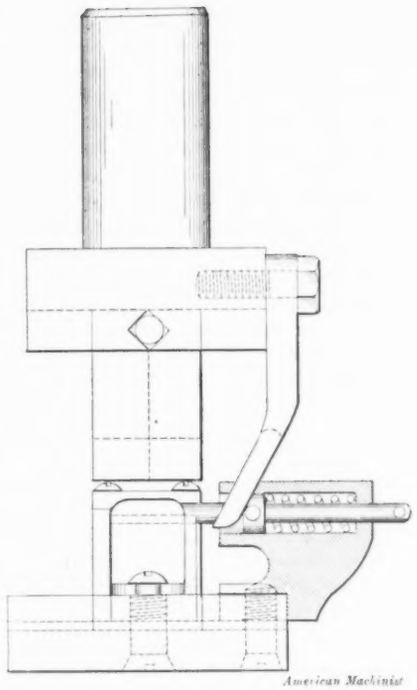


FIG. 2. END VIEW SHOWING OPERATION OF STRIPPER—NOT TO SAME SCALE.

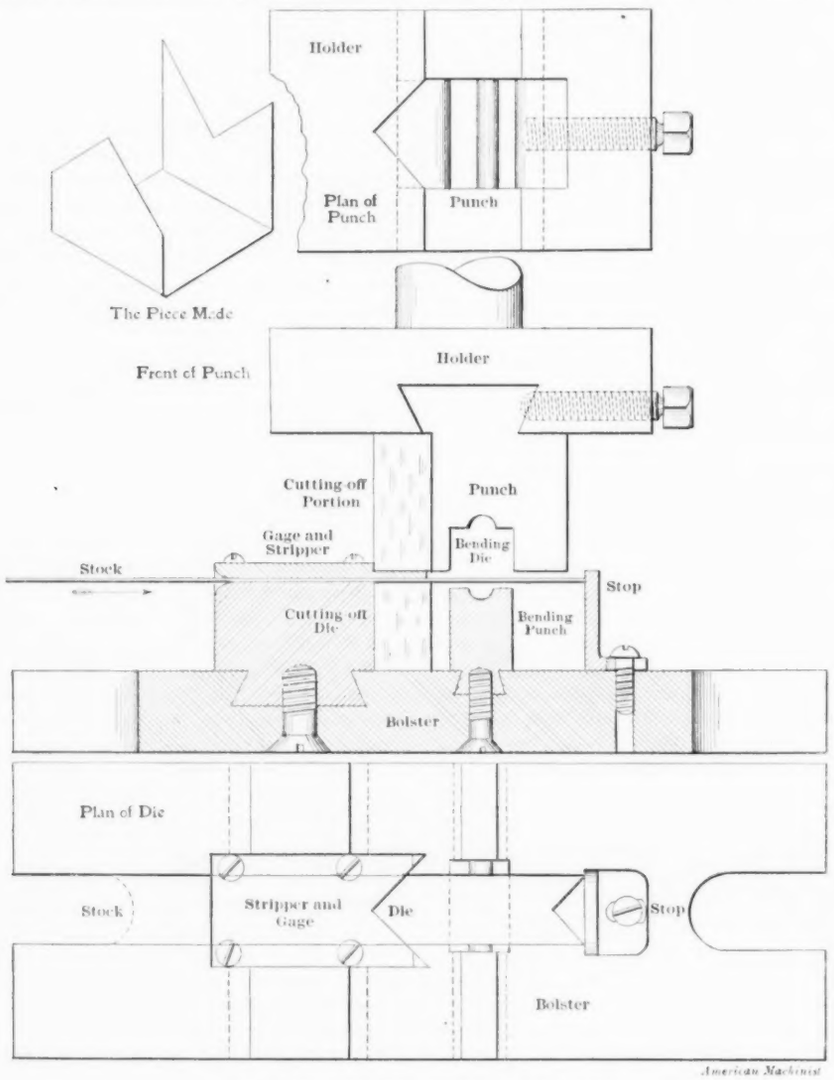


FIG. 1. PUNCH AND DIE FOR BOX SEALS.

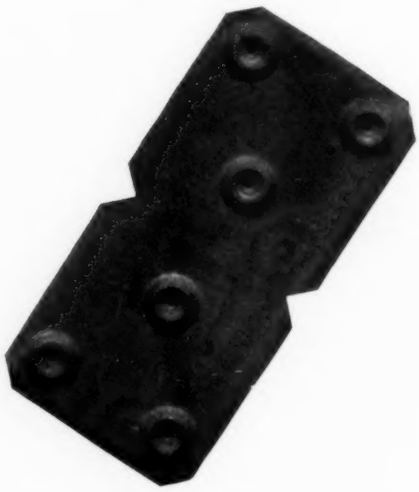


FIG. 3. CORNER PIECE FOR TRUNKS AND BOXES.

the bending portion of the cutting-off punch.

The stripping arrangement, as shown in Fig. 2, consists of the following parts, and is somewhat similar in construction to one shown in a preceding article on a die for wire bending. The stripper proper is a round stud let into a small casting located in the dovetailed channel for the bending punch in the bolster. This stud has a pin let through the back end to prevent it from springing out too far, when the punch is up, by the action of the spring at the back. A stronger pin is let through the enlarged portion or collar of the stud, so that the inclined fork, which is fastened to the back of the punch holder, will, while descending, move the stripping stud back and off the face of the bending punch.

When the die is in use, a strip of metal is entered beneath the gage plate and is allowed to project a slight distance beyond the cutting die. The press is stepped and the end of the stock is trimmed and finished to the shape shown in the plan of the die. The stock is then moved forward against the stop, and, as the punch descends, the piece is cut off and bent over the bending punch, the cutting punch descending about 3/8 inch below the cutting edge of the die. As the punch ascends, the inclined fork releases the stripping stud which springs outward and throws the finished piece off the bending punch and into a box at the front of the press. The parts are thus produced without waste and as rapidly as the stock can be fed. At first strips of metal were used in the die, but after a short time rolls of the required width with 200 feet in each were used. They were placed on a reel at the left of the press and the stock was fed automatically, through a pair of straightening rolls.

The article shown in the half-tone, Fig. 3, is a sheet metal box corner. These corners are made flat, and are intended to be bent at right angles after one end is nailed on to the box. The notches on the sides serve as guides for nailing the corner in the proper position, and they also facilitate the bending. The corner is so made that the edges bind the wood closely when nailed on, thus making a very rigid corner.

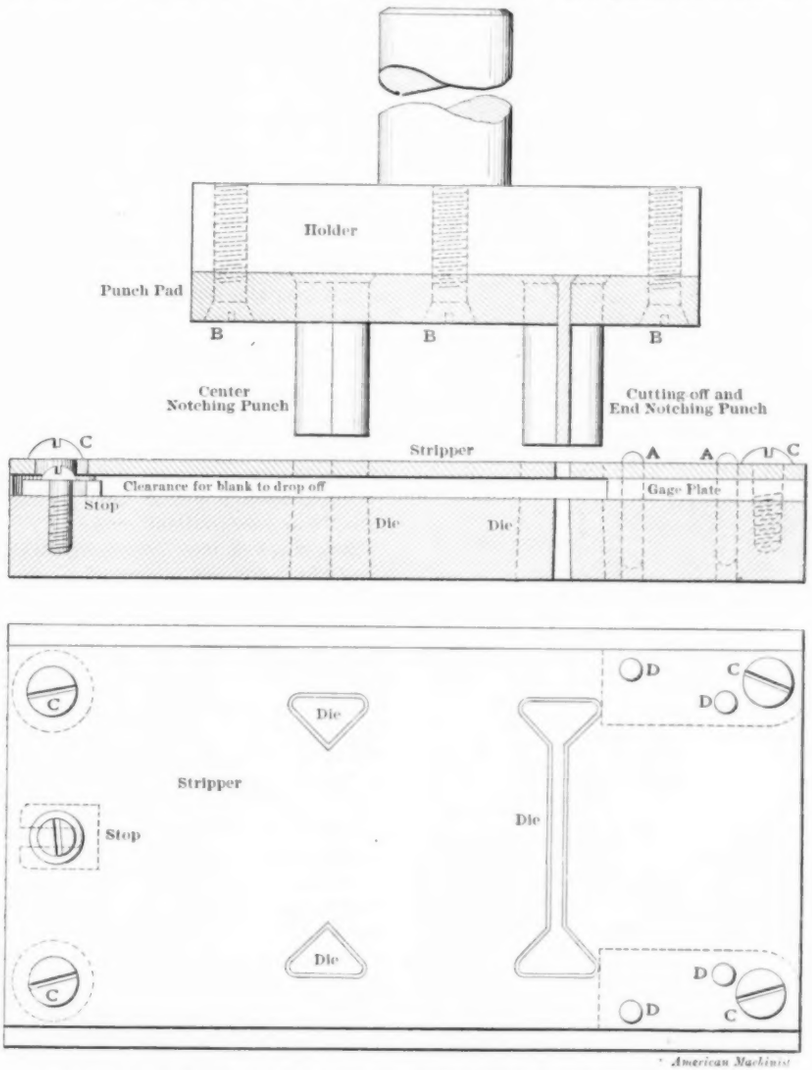


FIG. 4. PUNCH AND DIE FOR FIRST OPERATION ON BOX AND TRUNK CORNER.

Two operations are necessary. The first, that of notching and cutting off the blanks, is done by the punch and die shown in Fig. 4, a section of the punch and die and a plan of the die. There are three punches fastened in a machine steel pad, which is in turn fastened to the face of the holder by six flat-head screws. The end-notching and cutting-off punch is at the right, and is about 3-32 inch shorter than the center notching punch at the left. This is so that the center notching will have been accomplished before the blank is cut off.

The die is made in the regular way, with two short gage plates at the right end and with the stripper extending entirely across the face of the die. When the blank is cut off it drops off at the back, as the press is inclined and there is no gage plate to hinder it.

For the finishing operation—that of drawing and forming the six raised spots and perforating them in the center—the punch and die, Fig. 5 are used. The punch is in a dovetailed channel in the holder and fastened by two taper pins. The die plate is fastened to the bolster by two flat-head screws let in through the bottom. The dies proper are six tool-steel bushings, finished on the face with a forming tool to the shape required, and a small hole let down through the center. They are hardened and forced into counterbored holes in the die plate. The die plate is beveled at the edges to correspond with the punch at *F F*. The die plate is left soft and the punch is hardened. The drawing punch sections are at *E E E E*, and are finished as shown in the face of the punch. The gages for locating the work upon the die are three in number and are located as shown at *G G G*. The press in which the tools are used is inclined and the blank is placed on the die with two sides against the gages *G G G*. After the punch has descended and returned the finished work remains sticking to the die, from which it is thrown off by the operator by his entering a thin fork under the front right-hand end and snapping the piece off.

Both the dies shown and described herein were used in a sheet metal establishment in which rapid and economic production is absolutely necessary in order for their products to sell at a profit.

Echoes from the Oil Country.

TEMPERATURES IN SHOP WORK.

To begin with, the two men were not very good friends. I can't say that they were really enemies, but they did not care enough for one another to try to have a friendly understanding. This was rather unfortunate, as their jobs were such that they had to come in contact more or less. From lack of tact and consideration there gradually grew up the feeling that each one "had it in for" the other one. While such a feeling exists it is very easy to look at things in a distorted way and jump

at conclusions which a more careful view of the circumstances would show are erroneous.

Frank was a lathe hand, and part of his work was fitting the piston heads. These heads were wanted just right, and to get them right he used an inside micrometer to take the size of the cylinder and a large beam screw gage to give the size for the head. A definite difference was always wanted and insisted on, and this Frank maintained he always gave to within a quarter of a thousandth.

Jim was on the erecting floor and was responsible for any work that went on an engine, and it was on this question of fits that the most serious disagreement occurred. Several times complaint had been made to Frank that his fits were not what they should be. Again and again Jim had returned heads to the lathe to be eased off which Frank was willing to swear had been very carefully given the exact allowance called for.

Jim began to hold and express a rather poor opinion of the class of work he was getting from the lathe and the amount of unnecessary work it put him to, while the man at the lathe felt that he had an enemy that would only be satisfied when he left his job, as no amount of careful work seemed to stop complaints entirely. Indeed, he said that heads sometimes passed that he was afraid of, while those he was sure of were seemingly the ones most likely to give trouble.

I had tried to ease up the hard spots a little and to reduce the friction to such an extent that heat above the safe working point would not be generated between the two men when we had a little light on the subject.

Early one cold morning Frank put the finishing cut on a head and, throwing it up on to his shoulders, he started for the erecting room. Things had gotten to such a point that he did not feel safe unless he tried every head as soon as done and had judgment passed on it if he had any doubts, but in all cases every head must go in.

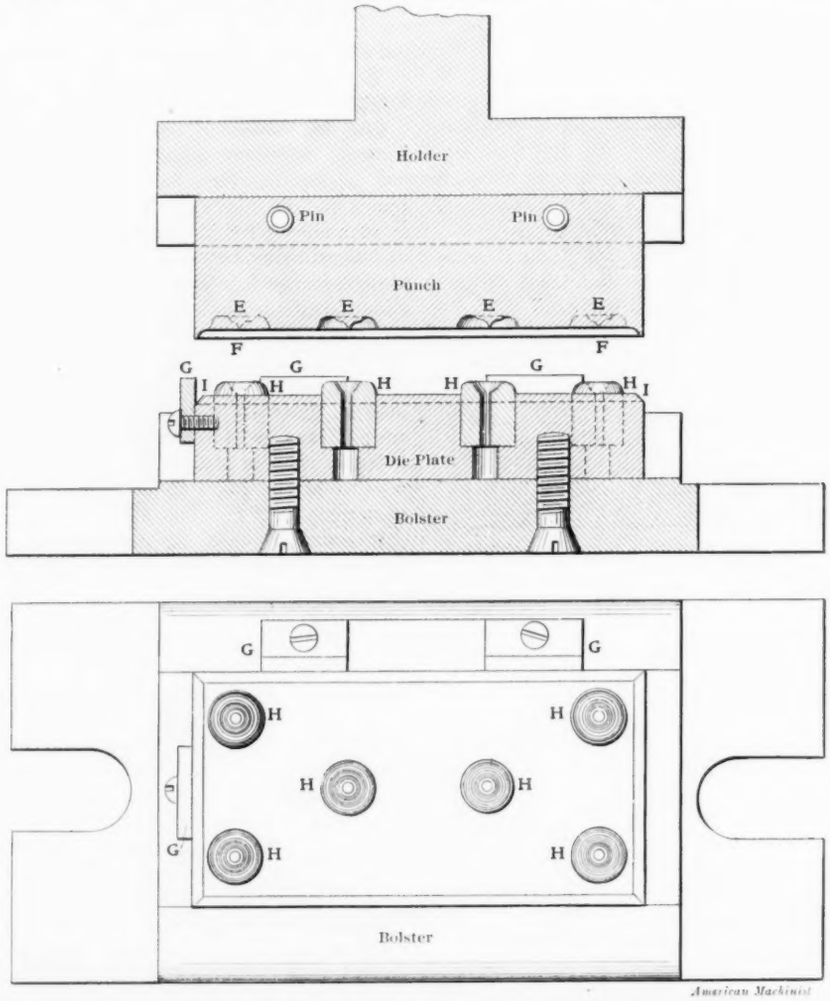


FIG. 5. PUNCH AND DIE FOR SECOND OPERATION.

In this case he started the head in, gave it a shove back until it struck the back end with a bump, pulled it out and set it on top of the cylinder and without saying anything started back to his machine. I had walked down a few feet behind him and saw it all and passed behind him on my way to another part of the works, being some distance beyond him as he turned from the cylinder, so that he did not notice my presence. Jim was working at the bench with his back toward us. A man at an adjoining engine also had his back to us, and between his engine and this one was a stove. I thought I saw a nice combination for trouble but decided not to stop, as I was in a hurry just then.

Coming back a few minutes later, I was hailed by Jim, who stood over by the engine with a tired, disgusted look on his face.

"Just see here a minute, will you?" said he. "This is a fair sample of how much good it does to try to explain things reasonably to some people. I've talked to that fellow until I'm tired, and yet here is the worst head I ever got. Just try that in once and see what you have to say about that kind of a fit. Then you will see whether I have any reason to kick or not."

I took the head and tried to put it into the cylinder and found it about right for a sledging fit.

"Is this the head intended for this cylinder?" I asked. "It must be; I found it setting on the cylinder and it is numbered for it," was the reply. And I sent for Frank:

"Frank, is this the head intended for this cylinder?" I asked. "It's the one that was setting on it." "Yes, sir," responded he promptly. He was sure of that fit.

"Well, Jim thinks it couldn't have been fitted for that one, as it is too large for it."

"You know it as well as I do," broke in Jim. "You just got done trying it."

Frank threw a look of disdain at him, seized the head and attempted to put it into the cylinder, turned it up and looked at the number, looked at the n mber on the cylinder and then looked dazed for a minute.

"There is something wrong going on here somewhere," he muttered; "I put the head I fitted clear in to the end so it hit, and it came out easy. If there had been a holler about it being a few millionths loose I wouldn't have been much surprised. Say, didn't you see me put a head in this cylinder a few minutes ago?" appealing to the man on the next engine.

The man shook his head. "I hadn't seen you down here before this morning, and the first I saw of the head Jim was trying to get it in and growling about the fit."

"You fellows down here must be putting up some sort of a job on me; you must have another head somewhere."

This made Jim warm. "You fit every head we get and ought to know that this is the only one of this size down here."

"Well, by gracious! I can swear I fitted that head very carefully just because of the kicking that has been going on, and then I tried it in myself, so there wouldn't be any chance for a mistake, and look at that, will you? I don't understand it—blamed if I do," and Frank stared first at us and then at the head.

"Well, Jim, what do you think of it?" I asked.

"I think if it went in once it would go in again, and I am mighty sure it won't go in now," he replied.

"Jim, I saw Frank put that head in and take it out again [Frank looked somewhat relieved], and it seemed plenty loose, too. I think if you two would just do a little thinking about these things, instead of each thinking the other was trying to do him, things would be easier for both of you and better for the shop. Can't either of you see what has happened?"

Neither one did.

"That is rather strange. Jim, it's pretty comfortable down here. How is it up in your corner, Frank?" said I.

"It's very cold up there yet," he replied, without seeing the point.

"Bring down your inside micrometer and set it to the cylinder carefully."

This he did and I had Jim try it. I laid it down on the cylinder where the head had been and took the head over to the bench and began to examine it slowly and carefully while I gave the micrometer time to get warm.

When we tried it again there was no mystery about what had happened to the head, and likely what had been happening before. Just a cold head and a warm cylinder; in this case a little more pronounced than usual, as the shop was rather cold and the stove was crowded. It was easy to see how a head that had been sitting by the steam pipe before being fitted might be loose in a cold cylinder.

While most machinists do not include a thermometer in their kit of tools, and it might be hard to use one to advantage if they did have it, yet it is a good plan to have a sort of mental one to apply to some cases.

Our results after this were obtained with greatly reduced friction, but it leaves a very interesting question. Does anyone mark his drawings in such a way that such things could not take place?

I was asked lately if I did not think it was good practice to so mark drawings that nothing was left to the judgment of the workman. Suppose it was possible to put marks enough on a drawing so that nothing was so left. I believe the man that could work from it and not have the work cost more than it should, could work from any crude sketch that left everything possible to the judgment and get as good work and more of it. *Somewhere* between these two is the proper drawing, but the very best kind of judgment is necessary to know just where. Personally, I like to get as much educated brains as mechanical skill in my workmen, as I find even a laborer without "horse sense" is a nuisance. But there is one thing I do believe in, and that is: ***Don't put a mark on a drawing that doesn't mean something.*** To this there should be no exceptions as applied to shop drawings. W. OSBORNE.

English Automatic Screw Machines.

The accompanying half-tones and line engravings illustrate two types of automatic screw machine built by Alfred Herbert, Ltd., of Coventry, England. While these machines are in general appearance similar to the Herbert regular automatic which we have already illustrated in these columns, it will be noticed that in adapting them to special work several novel and interesting features have been introduced.

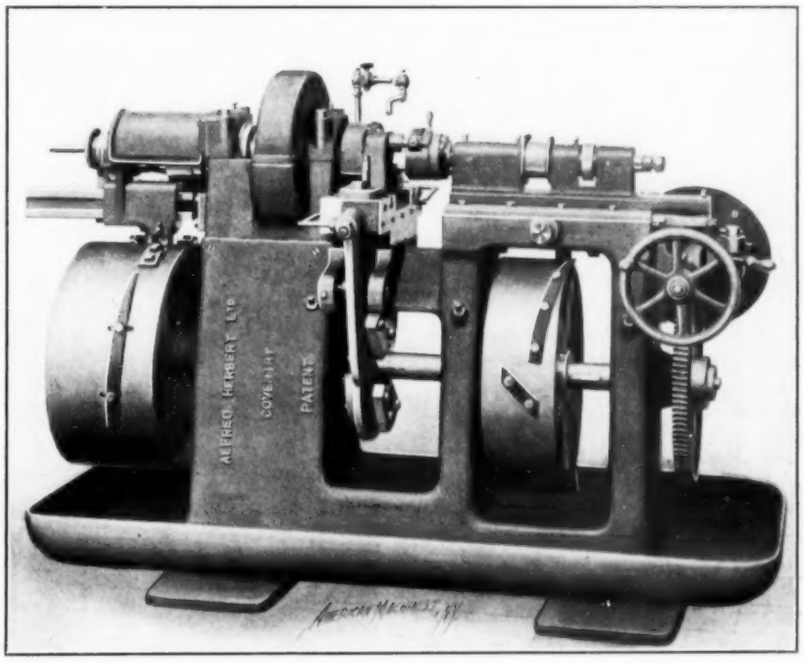


FIG. 1. AUTOMATIC SCREW MACHINE ARRANGED FOR MAKING CONDENSER FERRULES.

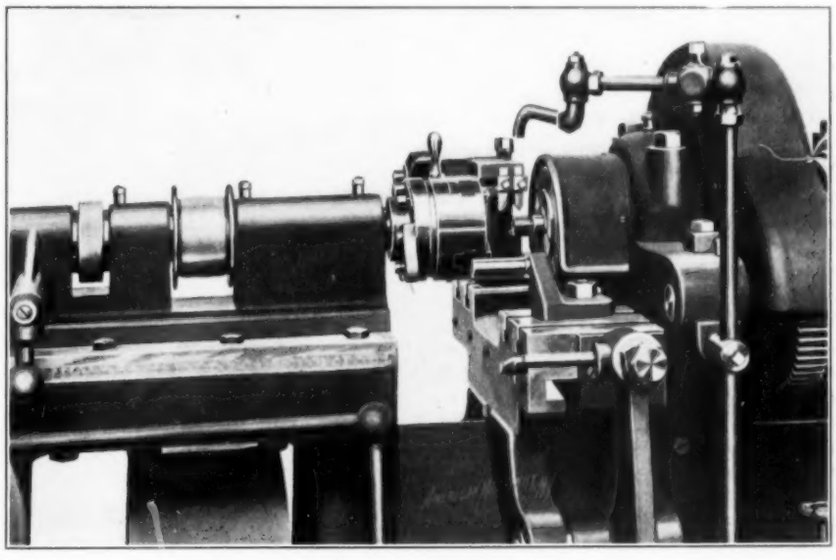


FIG. 2. REAR VIEW SHOWING WORK AND TOOLS.

The machine shown in Fig. 1 is designed for making condenser ferrules and similar work where boring and threading can be done simultaneously. Fig. 2, which is a rear view, shows the work and tools more clearly. The arrangement of the tool slides is given in Fig. 3 and a plan of the head in Fig. 4. The ferrules, which are made from brass tubing—held in the usual way in a drawback chuck—are $\frac{7}{8}$ inch in diameter by 1 inch long. They are threaded externally and bored out to size. In place of the usual turret slide the machine is fitted with a special slide which carries an opening die and a spindle for the boring tool. The main spindle carrying the brass tubing is driven at the proper speed for threading. The boring can of course be done at a much higher cutting speed, but the feed of the tool must be much finer than the pitch of the thread. The spindle carried in the slide and holding the boring tool is therefore rotated in a direction opposite that in which the work runs. Thus while the die and tool advance together,

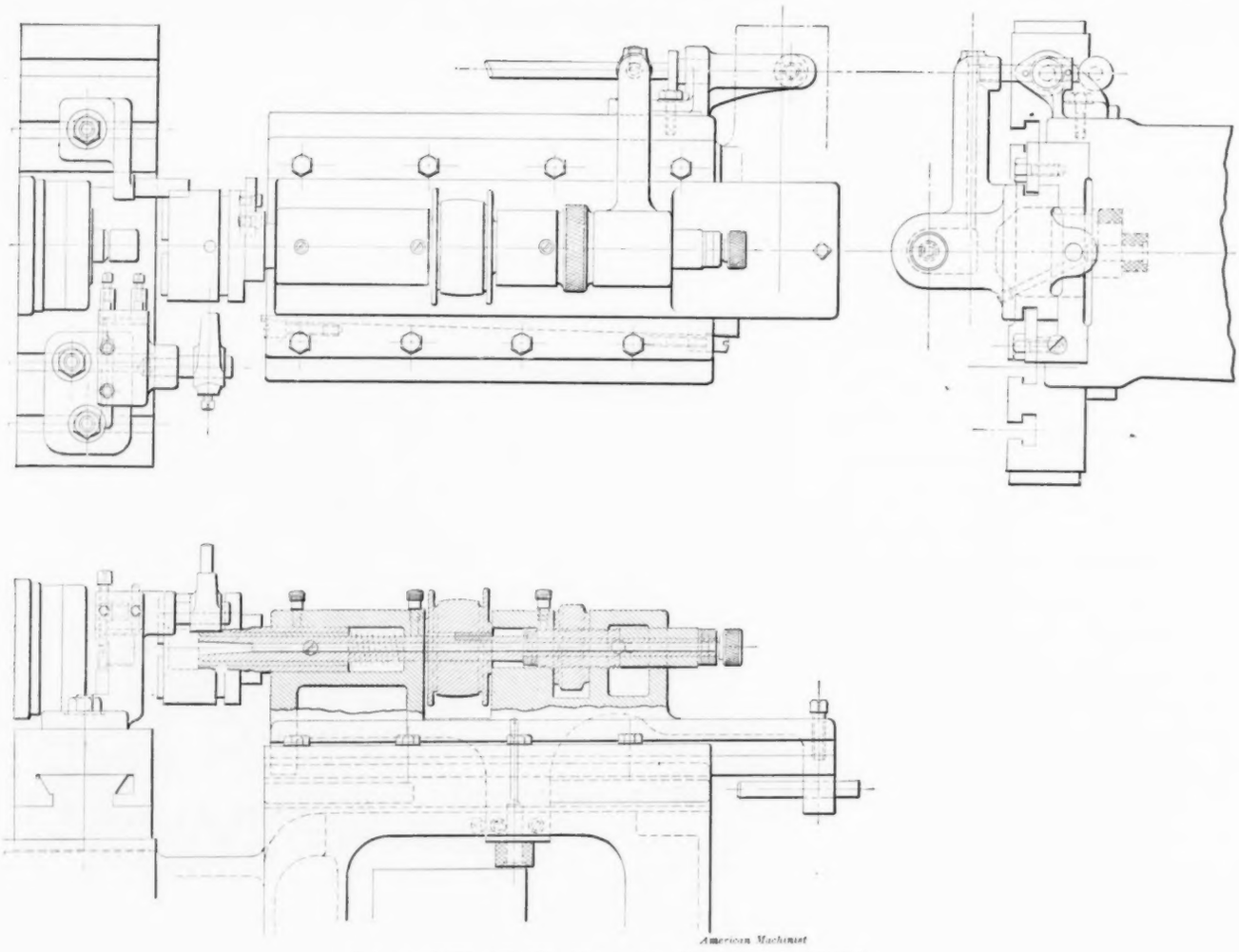


FIG. 3. SLIDE FOR DIE HEAD AND BORING TOOL SPINDLE.

when the slide is moved ahead by the cam on the drum below, the feed per turn of the tool is quite fine.

The ferrule, after being bored and threaded, is chamfered at each end by two small tools which are carried on a tool holder on the front of the cut-off slide and pass directly over the top of the work, the same holder carrying the cutting-off tool for severing the finished ferrule from the tube from which it is made. This tool holder also carries an adjustable finger which closes the die head when the slide is moved back to chamfer and sever the ferrule. On the back of the cut-off slide is a step which strikes a projection on the die head and opens the die when the piece has been threaded. The die head, which is a sliding fit in its holder and is prevented from rotating by a feather, has a spring behind it to allow it to give slightly when starting upon a cut and also to accommodate any slight variations between the feed of the slide and the pitch of thread cut by the dies. The internal spindle carrying the boring tool is adjustable endwise by means of a knurled head and a threaded sleeve. The oil supply for lubricating the tools and washing out the chips is carried down the center of this internal spindle, the oil reaching the slide from the pump through the medium of a telescopic tube fitted with a stuffing-box.

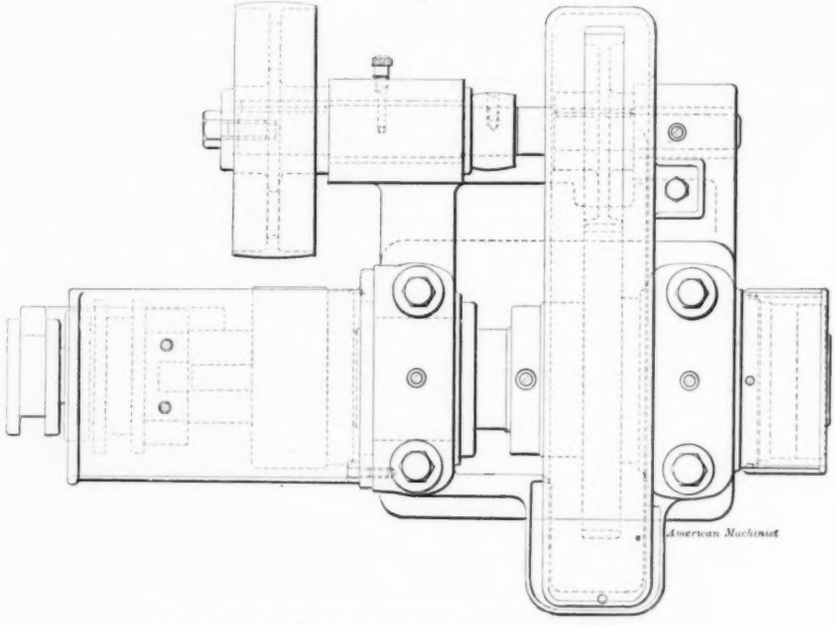


FIG. 4. PLAN OF HEAD SHOWING SPINDLE DRIVING GEAR.

On this work the spindle is driven at a constant speed and by a single pulley—as shown in Fig. 4—no reverse or change of speed being required; the cam shaft is also driven at a constant speed. The machine operates very rapidly—producing as many as fourteen ferrules per minute. This special apparatus is made in various forms. For instance, on certain work a tap can be substituted for the internal boring tool,

enabling a piece to be threaded outside and inside at the same time, even if the two threads are of different pitches, or a tap can be used internally and a turning tool externally.

The half-tone, Fig. 5, illustrates an automatic screw machine equipped with a magazine for handling castings—these particular castings being used for electric cable connections. The machine is shown with the magazine full, ready for work and with a finished piece in the chuck, and upon the turret slide will be seen several sizes and types of castings which this machine was fitted up for.

Fig. 6 shows the spindle and chucking mechanism, and Fig. 7 the construction of the magazine. The chuck is of the three-jaw type and operates against a very stiff steel spring in the spindle, thus allowing for variations in the rough castings. The jaws are provided with liners to suit various sizes, these liners being readily changed. The manner in which the chuck is opened and closed is clearly shown in the drawing and needs no explanation.

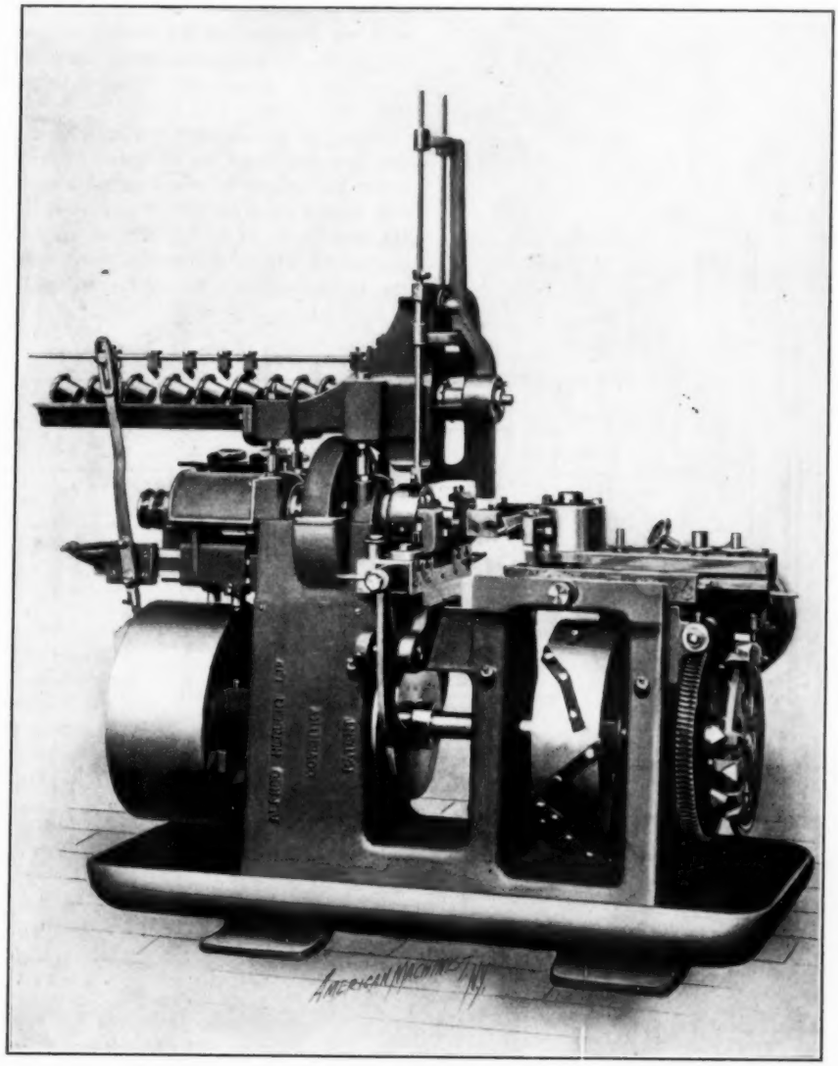


FIG. 5. MAGAZINE MACHINE.

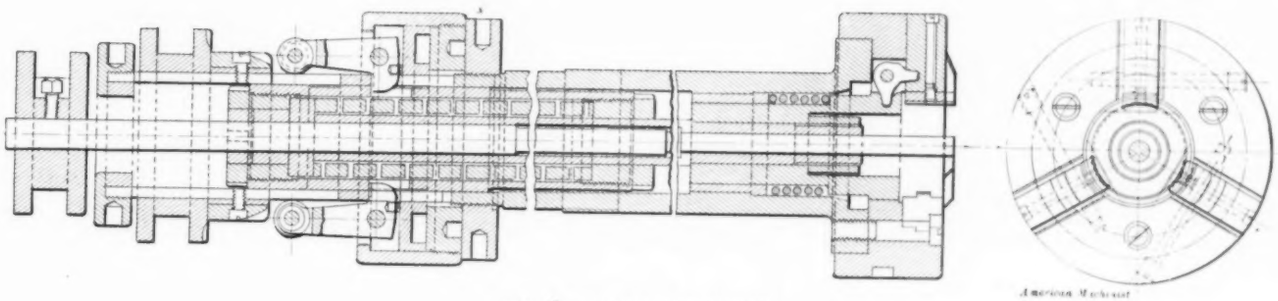


FIG. 6. SPINDLE AND CHUCK.

The rod at the center of the spindle ejects the work when completed.

The manner in which work is fed from the magazine into the chuck is more clearly shown in Figs. 8, 9 and 10; the machine in this case being fitted up for handling 1-pounder shells for quick-firing guns. Although the work is of a somewhat different nature from that in the machine in Fig. 5, the magazines are practically alike. The shells, which are made from a high grade of cast steel, have been bored out straight, formed outside and cut off from the bar at a previous operation upon another machine, and the function of the machine shown in the half-tones is to chamber out the interior of the shell and to thread the hole. The spindle carries a draw-back chuck, and in this chuck is a bushing which forms a stop for the shells and also admits the end of the ejector. The upper trough of the magazine is kept filled with shells, which are fed forward periodically by means of the long bar carrying the small adjustable pawls shown immediately above the trough, the feed bar being moved by a lever operated by a cam on the drum below. From the trough the shells are fed one at a time into a rotating carrier attached to a rising and falling slide. In Fig. 8 a shell has just been fed into this carrier. After the shell already being operated upon has been completed it is ejected. The carrier then descends to the position shown by Fig. 9, where the next shell is just about to enter the chuck. It is pushed into the chuck by means of a plunger in the carrier, this plunger being moved by a spring plunger in the turret. At the same time another small plunger is pushed in by an adjustable projection on the turret and releases the carrier, which turns over under the action of a flat spring like a clock spring, and assumes the position shown in Fig. 10. In this view the shell is chucked and ready for machining.

The carrier is now raised to its original position in Fig. 8, and on its way up is turned over to its proper position by means of a rack which engages with a gear ring on the carrier hub. The carrier mechanism is shown in Fig. 11, in which *A* is the carrier proper and *B* is the gear ring, which is a free fit upon the hub. At *C* this hub is provided with a series of ratchet teeth which engage with a pawl *D*

upon the gear ring. *E* is a small plunger carrying a tooth *F* which engages with clutch teeth at the back of the carrier and holds it in the position shown, against the action of the clock spring *G*. It will be seen from this drawing that when the carrier descends, the gear ring will rotate pawl to the carrier and thus rotates it back into its original position.

The lever for moving the vertical slide in which the carrier is mounted, is clamped on a square shaft shown at the back of the attachment. This shaft is rocked by a short lever which is connected by an adjustable rod with the cam lever hung below in the frame of the machine. This lower lever, being moved by a cam, has a fixed stroke; but by adjusting the nuts on the connecting rod, the position of the slide—when the cam lever roll is on the highest point of the cam—may be varied to bring the carrier into correct alinement with the work in the magazine. On the downward movement the slide is stopped, with the work in line with the chuck, by means of an adjustable stop collar placed on one of the vertical rods. This adjustment at top and bottom is very important, as the position of the carrier must vary with the diameter of the work. In addition to the vertical adjustment, the magazine has an adjustment endwise to and from the chuck.

This type of magazine has been used by this firm for chucking all kinds of pieces where the length is greater than the diameter, one of its great advantages being that the same form of trough can be used for a great variety of work. In cases where the pieces will not lie in the trough in such a position that they can be easily chucked, small shoes are made to carry them. These shoes hold the pieces level until they are chucked and then drop off into the tray. They can afterwards be collected and used over again.

In forming the chamber in the steel

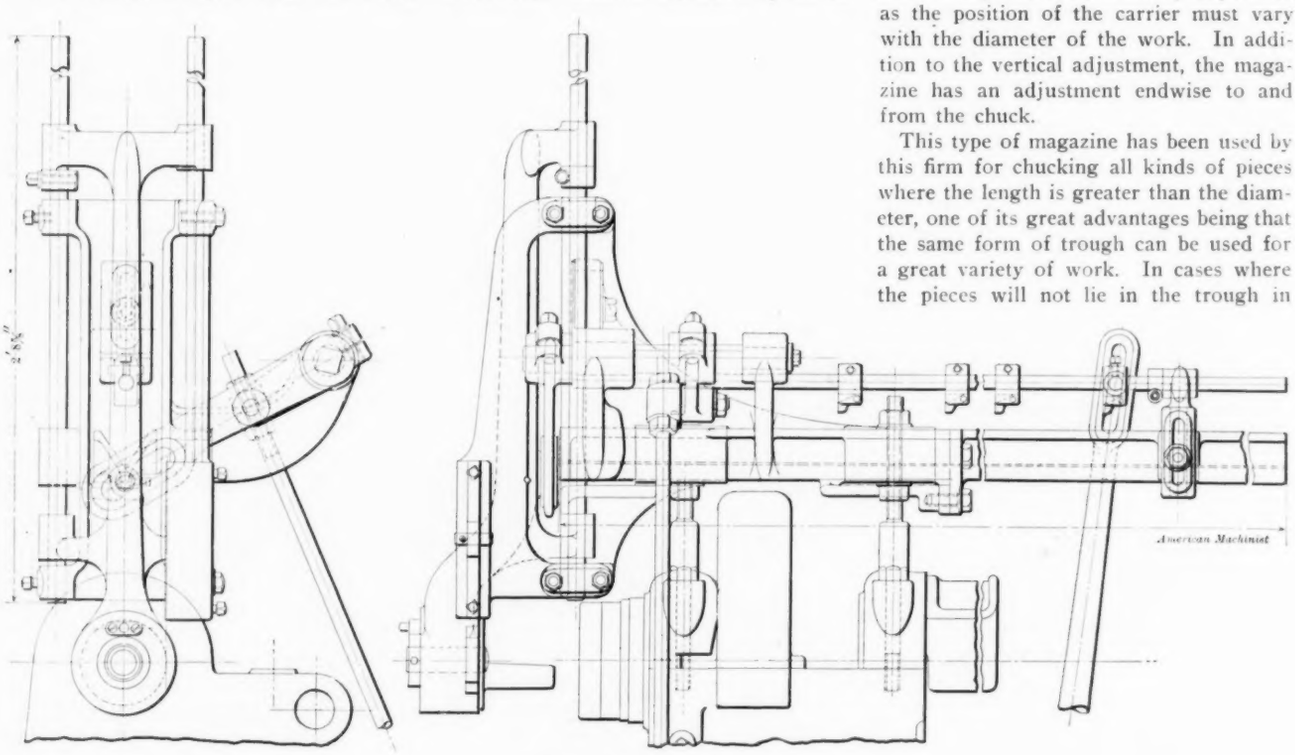


FIG. 7. THE MAGAZINE.

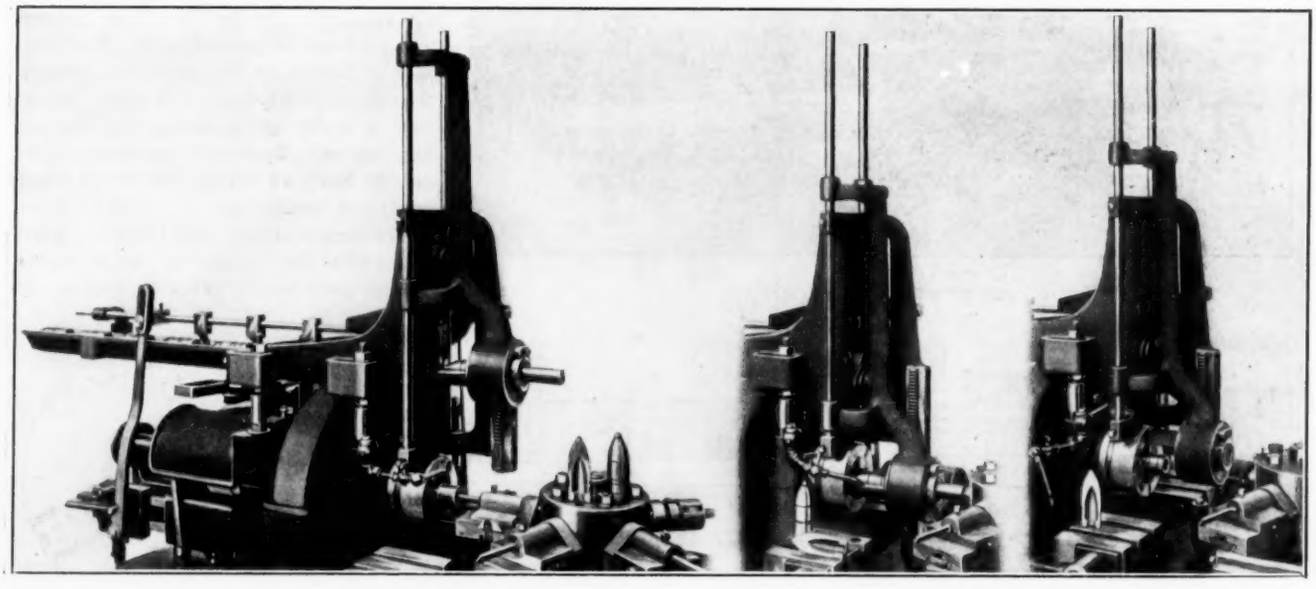


FIG. 8. FIG. 9. FIG. 10.

MAGAZINE FOR HANDLING SHELLS.

freely upon the carrier without turning it, the pawl slipping over the ratchet teeth. When the carrier rises, however, after having been turned over by the clock spring, on the release of the plunger *E*, the rack on the magazine rotating the gear wheel transfers this motion through the

shells three turret tools are used, each tool being adjusted to do its share of the work. The construction of the tools is shown in Fig. 12. The body *A*, provided with a shank fitting the turret hole, is cut out dovetailed at the bottom to receive a slide *B*. On this slide is secured a former *C*, which is shaped to suit the chamber in the shell. A long spring *D* holds the slide back in place in the body *A*. The cross slide *E*, fitted to the top of *A*, carries the tool bar *F*, this bar being provided with a hole for admitting oil to lubricate the tool and wash out the chips, In the cross slide is a screw *G* carrying a shoe *H* which is held against the former *C* by means of the spring *J*. By turning the screw *G* the tool can be adjusted to the cut. The tool is run in to the bottom of the hole and cuts on the return. When the turret moves up, carrying the tool into the shell, a spring plunger *K*, fitted in a holder secured to the front end of the turret slide block, engages with a tooth *L* on the bottom of the former slide *B*. The slide is thus kept from moving when the turret is drawn back. The former being held in position, the shoe *H*, as it slides along, moves the cross slide *E*, and the cutting tool forms the chamber in the shell.

When the shoe reaches the back of the former it snaps over the end, the spring returning the cross slide to its central position, so that the cutting tool—as it is withdrawn by the turret—will clear in the smaller hole in the outer end of the shell. When the turret rotates, a pin *M* in a spring plunger *N* in the back of the body *A*, strikes a steel plate *O* behind the turret and forces the plunger ahead. This plunger is milled out at *P* and in the notch rests a pin *Q* carried in the bottom of the cross slide *E*. When the plunger is forced ahead by the plate *O* the inclined surface at *P* moves the pin *Q* and slide *E*. The shoe *H* thus being withdrawn from behind the former *C*, the slide *B* is forced back by the spring *D* into its original position in the holder.

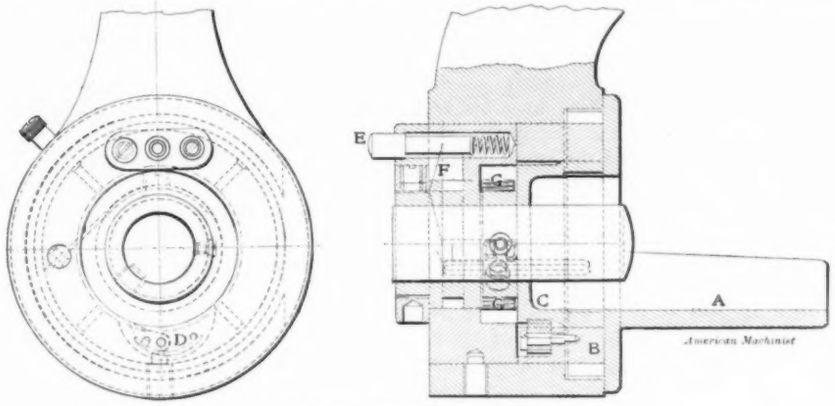


FIG. 11. ROTATING CARRIER.

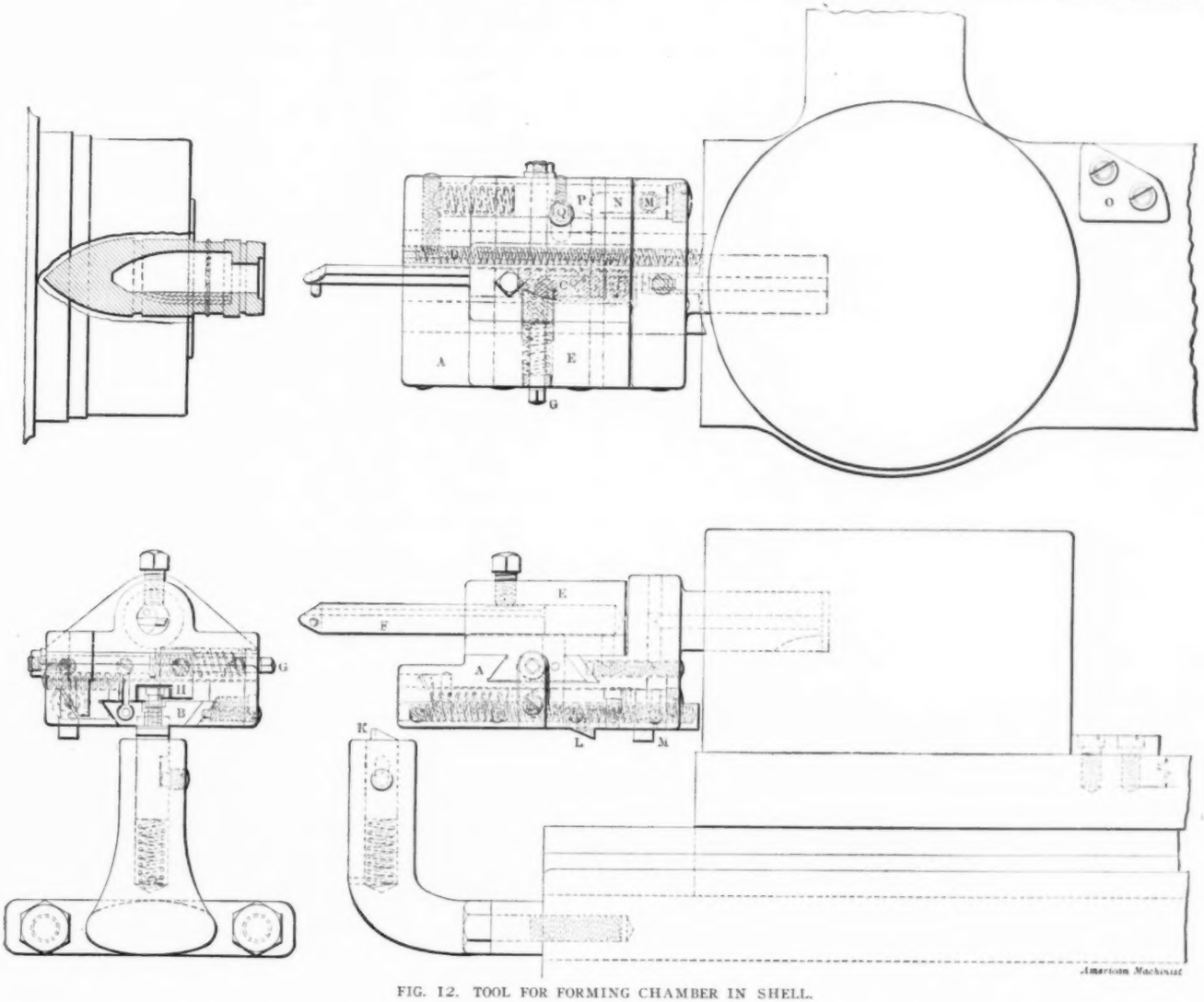


FIG. 12. TOOL FOR FORMING CHAMBER IN SHELL.

The tap for the hole at the back of the shell is carried in a self-releasing holder, shown in place in the turret in Fig. 8. The teeth on this holder disengage when the tap has reached the required depth. When the spindle reverses, a spring pin in the holder engages with a ratchet on the shank of the socket, holding it stationary while the tap is withdrawn. The holder is carried in a socket provided with a spring which gives the pressure necessary for starting the thread when the tap is brought up to the work.

The Need of Practical and Technical Training.

SOME EXPERIENCE WITH SCHOOL-TRAINED DRAFTSMEN—THE COMPENSATIONS OF THE ENGINEER.

BY G. E. FLANAGAN.

An incident illustrating one result of the inability to read drawings occurred some years ago. A workman was given a set of drawings and told to collect all the details shown thereon in one place. It was known that they had all been made, but they were still in various parts of the plant. He found most of the pieces readily enough, but one, of which three views were shown, he located by its resemblance to two of them, and, supposing the third view to represent another detail, he spent half a day looking for it.

The lack of practical knowledge of another kind sometimes furnishes just as much cause for merriment as the case above mentioned. A certain drawing for a double crane hook, designed to be of cast steel, was interpreted by the pattern-maker in a way that brought a smile to the face of nearly everyone who looked upon the result of his labors. He was not fairly to be blamed for this, the drawing being plainly at fault, and he was a competent workman, but a little better acquaintance with the principles of mechanics would have convinced him that no designer could possibly have intended such a monstrosity as his pattern represented.

School-bred draftsmen who are lacking in shop experience often fail to realize why it is their technical training does not render them of more value than men whom they consider comparatively ignorant. Most of them wake up, however, when repeatedly brought face to face with the fact that the men with the shop or office experience can do what is required of them, while the mere technical graduate cannot. The shopman is just as helpless when confronted by the need of a calculation which he has never learned how to make, but this is a case of less frequent occurrence, since whatever position may be held by the man of experience it is generally one which he has gained by first demonstrating his ability to fill.

I have in mind two young men who were unusually brilliant as students. They were from widely separated schools, but they had both become experts in mathematics and both had assisted as teachers of mechanical drawing. With all this they had the usual experience when they came to do commercial work in the drawing office. I requested one of them to calculate the center of gravity of an irregular section and he brought an answer that was visibly wide of the mark. A slight error in the beginning had vitiated his calculation. Anyone of the boys in the office could have guessed more correctly, as, of course, he himself could have done, but he was not used to guessing. He could calculate with facility, and the result would then be exact, saving, as in this case, the possibility of making a mistake. With three or four years' practical experience his trained sense of what looks right would serve as a check upon his figures and make evident to him at once the existence of any serious error. The second of these men was engaged in making a drawing of a steam boiler. Practically all that was required was a modification of another drawing which was given to him for reference, but a new feature required was a manhole casting in the form of a cylinder about 18 inches diameter; this he arranged for ⅜-inch rivets, 3 inches pitch, and with never a thought of caulking the seam between the cast iron and the boiler shell. He seemed to feel hurt when he found his ⅜-inch rivets changed to ⅞ inch. The boiler was intended to carry only 80 pounds of steam pressure, and he was sure the rivets were ample to resist this. The question of making the joint steam-tight did not enter into his calculations, but only its absolute strength. A really first-class structural draftsman was called upon to assist in designing a large plate shear. This work was nearly all to be made from cast iron, a material with which he was not very familiar. One part, which he had proportioned to resist the strain known to come upon it, we made five times as heavy as he designed it, but it broke in use nevertheless.

The technical man is very often disappointed that he does not secure a better position when he first makes an offer of his services. I know of the case of a young man who, after receiving an expensive education and acquiring a respectable technical library, was unable to earn more than $15 a week at the first work which he found to do. In utter disgust at what he considered the poor prospect of remuneration in the engineering profession he sold his books and instruments and opened a saloon. This seems to be a case of the survival of the fittest, or rather of the elimination of the unfittest, in the domain of engineering. A young man who was so easily discouraged, and who could so easily sacrifice his education and his chosen vocation, to say nothing of his social position, to a desire for an immediate financial return, was never fitted to be a successful engineer. Another young graduate took quite a different view of a similar situation. While working for a small salary for one of the great railroad companies and living in hopes of a day of better things, he was offered an interest in a large chicken farm, on the sole condition that he would take an active interest in the business. After very courteously declining to accept the offer he expressed himself in more forcible language to a disinterested acquaintance, saying that he would see himself hung on the other side of a very hot place before he would quit engineering to go and raise chickens.

There are other compensations in this world than those of a strictly pecuniary nature. Many occupations might be mentioned which it would not profit an engineer to engage in, even though he might thereby acquire several times as many dollars per year as his profession procures for him. The mental development resulting from working in this broadest of all broad fields is worth more than money. Although not the oldest of the professions, that of the engineer is in many respects the widest of them all. Even a moderate share of success in this line not only implies but, it may almost be said, requires a knowledge of many things. A doctor may study, and most of them do, but some who do not are fairly successful, and the same is true of lawyers and others; but there are few quack engineers. The laws which they learn to respect are those of nature, and if not strictly observed the results become at once apparent. Their success is never dependent upon popular ignorance, but is rather the result of a sharp competition with their peers, and their work is at all times visible and open to the inspection of experts. While in any line of human endeavor involving mental activity there is room for the exertion of intellect of the highest order, in most fields a certain amount of apparent success may be attained by pretension, unsupported by real knowledge. The lawyer may mislead his clients and the doctor his patients; the statesman may fool the people some or all of the time; but the engineer deals with people who expect positive results, and who are not accustomed to paying for anything without getting it.

Prof. Perry's fears with regard to the exhaustion of the world's coal supplies appear to be entirely set at naught by Mr. D. E. Hutchins, who, in a letter to *Nature*, from Swellendam, in Cape Colony, puts it that the forests of the globe, fully stocked and scientifically worked, would yield annually the equivalent of from 30 to 120 times the present consumption of coal.—*The Mechanical Engineer.*

An electrical contemporary is offering to give with each subscription a $1,000 accident insurance policy. We do not know on just what basis this offer is made and of course hesitate to conclude that a man who subscribes to the paper in question is in particular or special need of such a policy.

Letters From Practical Men.

System and Discipline in the Shop.

Editor American Machinist:

Referring to the difficulty of keeping things in order around the shop, as complained of by "Dutch" at page 1022, it is necessary to consider first principles. In the administration of human affairs it has been proven by ample experience that the best way to get anything done with certainty and thoroughness is to make it the particular duty of some competent man to see that it is done, and to hold this man responsible for neglect of duty. This implies that the responsible person must be allowed control of all the means necessary to produce the desired result. Incidental to this and equally important to ultimate success, it is necessary to furnish a suitable incentive to the one responsible, so that there will be sufficient inducement to assume the responsibility. These principles seem simple and are apparently easy of application; yet it is nothing else but the failure to apply them which causes most of the disorder and waste in shops.

Referring to the case at hand, it is clear that it has not been made the particular duty of anyone to see that the tools are put away or that the shop is kept in order, and that it would be difficult, if not impossible, to hold any individual responsible for the general disorder. It is a trite saying that "what is everybody's business is nobody's business," and this is a practical example of the truth of it.

As suggested by Mr. Tecumseh Swift, the adoption of a toolroom is the first necessity of the case, and so far as I can see there is really no good reason why "Dutch" should not have one right away. The very thought of a toolroom, however, seems to scare some shop proprietors at once, and it requires strenuous effort on the part of someone to get it started. Of course it will cost something to partition off a corner and provide suitable places for the tools, but, after all, it costs less to have a toolroom than it does to do without it. This may appear incredible, but I think it can easily be proven.

Regarding the difficulty of getting men to clean the tools and put them away, there is much natural difference among men about it, and there are many excellent mechanics that are lax in this way, and whom to discipline for it would not pay. Mechanics are hired to get out the work, and if they do this well and rapidly, spending less time cleaning and putting away tools, it will be more profitable to have a cheaper man to care for the tools. Having a toolroom with someone in charge does not cure careless men of their habit, as they are about as careless in returning tools to the toolroom as they are about putting them anywhere else; but it makes it the particular duty of someone to care for all the tools, and when a tool is called for to be able at once to tell who last took it from the toolroom. If any tools are lost or damaged the responsibility can be located without any difficulty, and this exerts a good influence toward the better care of tools by those using them. In a small shop it does not pay to put an expensive man in charge of the toolroom alone, as too much of his valuable time is spent in handing out tools and other work that an intelligent helper could do just as well.

If there is room enough, there should be a good small lathe in the toolroom, suitable for making all the small tools, a drill press, tool grinder and a good vise bench with one small and one large vise. A skilled man may then be employed there to make tools when needed, and the rest of the time to do regular shop work. He should have an intelligent assistant to give out the tools and look after them generally, who, during his spare time, can be employed grinding tools, running the drill or doing rough bench or vise work, such as can always be found by the foreman. The assistant may be an apprentice or helper who should be directly responsible to the mechanic in charge of the toolroom. If the toolroom space is limited, have at least the drill press and vise bench and put an intelligent helper in charge and train him for the place, giving him an advance on regular helpers' wages and promise of a steady job. His spare time can be employed drilling and doing bench work, etc., and it will prove an economical arrangement.

Mr. Swift touches a vital point when he insists on the necessity of light in the closets to promote cleanliness. Light is the symbol of purity everywhere, and it is almost impossible to find a dark and gloomy shop anywhere which is clean and orderly, simply because the two things are incompatible.

Dirt is defined simply as matter in the wrong place, and dirt in a shop does no harm so long as there is not enough of it to retard the progress of work, but when it reaches this point it should be cleaned, no matter how often that may be, provided the cost of cleaning does not amount to more than is saved by it.

That a shop is always neat and clean is no certain proof that it pays to keep it that way, and being strenuous in this way may easily cost more than it is worth.

When a shop only has enough work to keep all the tools going without any rushing it is easier to keep the shop neat, but when work is crowding and it worries the foreman to tell what job to give the preference and the days do not seem half long enough, the shop will look more disorderly; but don't worry about it, for that is when the most money is made. The best and most energetic workman will have the most shavings around his bench, will require the most material, will have the most jobs piled around waiting for him and will make the most dirt, and will spend the least time cleaning up; yet a shop full of this sort is the most profitable of all.

Perhaps the foregoing may be of no use to "Dutch," but it will make interesting reading to have a good variety of opinions, and I hope that after he has digested such of them as agree with him and put them into practice, that he will report the results in as thorough a way as he stated his troubles.

BELL CRANK.

Catalog Filing and Indexing.

Editor American Machinist:

As you have considered this subject of enough importance to describe, at page 786, the system in use in your office, I take it that you will not object to a description of another method, which I think is equally efficient, less expensive, and perhaps has greater adaptability to general purposes.

The indexing is done on cards similar to the way you describe, but the marking and filing of the catalogs is on an entirely different plan. The catalogs are filed in pamphlet boxes, furnished by the Library Bureau, of which there are nine sizes, each designated by letters from A to I, and ranging in size from 1½x4⅛x6¼ to 2¾x10x14¼, inside measure. These boxes are made of stiff pasteboard, having one edge attached with a cloth hinge and one-half of one side also hinged and provided with three flanged edges which shut over the outside of the two ends and the hinged edge, making a close fitting, almost dust-proof box. These boxes are placed on end on shelves like books, and, when taking out catalogs, are laid on one side on a table with the hinged side up, when, upon turning back the half cover, the desired catalog may be selected without removing the others, by simply turning up the corners until the right number is found. It is not necessary to use all nine sizes, as the library I refer to uses only seven, and for a small collection a less number would do. Each catalog is filed in the box which is nearest the right size for it. A small label is pasted on the upper right-hand corner of the back cover of each catalog, and on this label is written the size letter, followed by a serial number, beginning with No. 1 for the first catalog of each size. Thus the first catalog filed in A size box would be marked A1 and the second A2, and so on. The catalogs are filed in the box with the lowest number on top.

The boxes have a label on the back which is marked with the size letter, followed by the first and last catalog number in the box. All boxes of the same size are kept together and arranged so the label numbers follow each other. All bound catalogs which do not require a box are assorted by size and put on the shelf ahead of the corresponding size box and labeled on the back with two letters alike and a consecutive number, thus: AA1, AA2, and so on.

One of the chief virtues of the card catalog system is its indefinite expansi-

bility and flexibility, and this condition is strictly complied with in the above arrangement, which has no limit except shelf room. The limit of size numbers in the AMERICAN MACHINIST library may never become a practical objection, but it does not satisfy the ideal condition, and I think it is best to use another kind of size symbol.

When it comes to indexing, there is a great chance for judgment and discretion, and to get the full benefit of a catalog library this work should be done by a person fully competent, and with special reference to the future needs of the establishment using it. Of course it is necessary to index all the firm names, and more or less completely by names of the articles.

All catalogs listing a variety of products should be examined, and each article which it is thought may some time be needed, marked with a check mark, which may often be conveniently done in the index contained in the catalog. The clerical work of indexing may then be done by office employees of ordinary attainments. It is also sometimes best to check mark the particular title of certain articles under which it is desired to have them indexed, to secure a better classification.

When a new catalog is received from a firm, it is not always best to throw away the older one and put the later one in its place, for it is sometimes necessary to refer to it for repairs of older machines still in service; hence this point should always be considered before destroying a catalog.

When filling the filing boxes, if it is intended to throw away old catalogs and substitute the later, there should be some room allowed in each box for this, as it nearly always happens that the later catalogs are thicker than the old. This is a weak point in the system, as it is about impossible to judge how much space should be allowed for thicker catalogs where it is intended to substitute. More room of course may be secured by relabeling the whole series of boxes, but as this is easily done and does not affect the indexing, it is not a serious fault.

In the index of firm names the name on the card is followed by the label numbers of all the catalogs in the library from that firm, no attempt being made to indicate the contents of the different catalogs; but there is no doubt that the method you show on the card, Fig. 4, is the best.

Single page circulars, clippings, letter sheets, etc., file very nicely among catalogs in the boxes, as they are always put in while lying horizontal, and the label being on the corner like the page number in a book, is easily found.

You remark that the system you use "prevents a catalog from going back into the file, except in its own place." Now that seems very nice, but I fail to see how it "prevents" when a catalog has been taken out of the file, as it has no string on it to pull it back to its proper place, and with due regard for the best intentions they do sometimes get put back in the wrong place, and then are just about as difficult to find as when all are in one pile.

BELL CRANK.

Home Made Tools.

Editor American Machinist:

Your editorial on the "cost of home-made tools," at page 1092, strikes a topic which should, I suppose, interest many men of the shop as it does me. The cost part of it, I confess, interests me the least. There are many different kinds of tools and many different conditions under which they may be built, but the tools and the conditions are, I think, few where, if the figuring is honestly and *completely* done, any pecuniary profit will be found in making tools instead of buying them of established builders. Nevertheless, in spite of the bad showing, it is proper sometimes or oftener, to build the tools. You can prove every time that the use of compressed air entails a considerable waste of power, and power is money, you know, yet we will continue to use the pneumatic hammer and the air hoist.

Of course it is not to be thought for a minute that the ordinary shop can build any of the standard machine tools, lathes, planers, drills, shapers, millers or any such tools without losing money, and generally after all getting tools which are not as good as the best. Saying nothing of the patents which most builders have on some of the details of their tools, they have the patterns, the numerous jigs and small tools and special appliances, the men each trained to the accurate and reliable doing of his appointed part, so that each is done by the best man on the best adapted machine, and in considerable numbers instead of singly; they have the experience which tells the best material for each part and where to get it; they have arrangements for supplies of factory-made small parts, which are such an important element of modern manufacture; they know the weak spots which still lurk in their product and what defects to look out for. Why, with all the advantages the regular builder has, the home-made builder of the single tool will often do well if he can turn it out for double the money. The builder, unfortunately for him, has not to compete only with the shops who build tools for their own use, or he would be happy. He has to compete with those who build for all creation, and between them I don't believe they have left any too much still to struggle for.

With the making of special tools which are not on the lists of any of the manufacturers, and which no one of them has ever built, the case is quite different. None of the usual advantages of the established builder would here avail him. If he had all the patterns to make, if none of his jigs and other time-saving appliances would be available, if he had only a single tool of the kind to make instead of a dozen or so at a time for the general market, and if his shop, besides, was pretty full of work, as has recently been the fashion, he might be expected to put his figures up quite high in making a bid for the job. Then if after all the man who wanted the tool should build it for himself, it being assumed that he was a competent mechanic and his shop excellently equipped with both tools and men, he might, when all was finished, be able to persuade himself that he had saved some money by building the tool.

As is suggested in the editorial, it is quite generally the fashion in figuring up the cost of the home-made tool to forget, or otherwise omit, some of the ingredients, and there are many cases where the self- (or other) deception is not far from justifiable. It is becoming a tradition of the trade that managers of railroad repair shops have a way of making a good showing for the costs of their home-made tools. In their case, almost anything would seem to be justified, for if they did not get the home-made tools they often would not have any.

After you have carefully got together every item of cost of material and labor, and added also for the "unproductive" labor and the other items of the "shop burden," there is still another item which the editorial in the AMERICAN MACHINIST failed to mention, but which in busy times is worth remembering. The men and the machines employed in building the new tool, it is to be assumed, would have been employed in any case, and it is to be hoped they would have been so employed to the profit of the employer. It would seem to be fair, therefore, to add also to the cost of the tool, after the shop burden, an amount representative of the clear profit which would have accrued if the men and the tools had been employed upon regular work, and only the balance which survived all that could properly be called profit or saving.

When everything is thus remembered it would seem to be anything but easy to figure out pecuniary profit in the making of home-made tools, and yet I doubt not the history of the development of the trade, if it could be accurately written would show a large indebtedness to this very thing. It is to be remembered that the tool builders themselves, the same as the general trade, can build for themselves home-made tools. I have read many times the story, doubtless often true though found in a manufacturer's catalog, that the first sample of a given machine tool was made by the builder for his own use, that it was found to be so satisfactory, and all that, that it was licked into shape and perfected and offered to the trade. Some of the tools or lines of tools of the most satisfactory of the tool builders of to-day have been develped from original home-made tools of machinists who previously were doing only a general jobbing business. The making of home-made tools has often helped to keep a shop going

through very bad times and retained good workmen for more profitable employment later, and the advantages secured in this way might well be taken to offset some of the apparent losses in home-made tool building.

The machine tools that we are to use are not all made nor invented nor in sight yet. The improvements upon existing tools, and the new tools, if there ever are any more that can be called new, are rather more likely, I take it, to be found first among the home-made tools than anywhere else, so that it is to be hoped the building of home-made tools will not be entirely killed off by the figuring on the cost of them. There is one line of tool building that is still not very costly, and that is what is done entirely by the draftsman. When he gets a tool thoroughly built, you can tell pretty well how it will work and what will be its advantages without going through the tedious and costly process of construction. Here is one of the most promising fields for the young and aspiring draftsman. Any enterprising fellow of the shop, instead of drawing and re-drawing valve motions and the other details of the steam engine, can in many cases do much better for himself if he will go to drawing home-made machine tools. The making of chips gives opportunity for a greater variety of mechanical devices and arrangements than does the expansion of steam; the former as a field of invention, we may also believe, is not as near the completion of its working out as is the latter. The promise of future advantage to be gained by the new machine tool is still greater than that of the new steam engine, so by all means let the making of the home-made tools still go on.

TECUMSEH SWIFT.

A Large Expansion Joint.

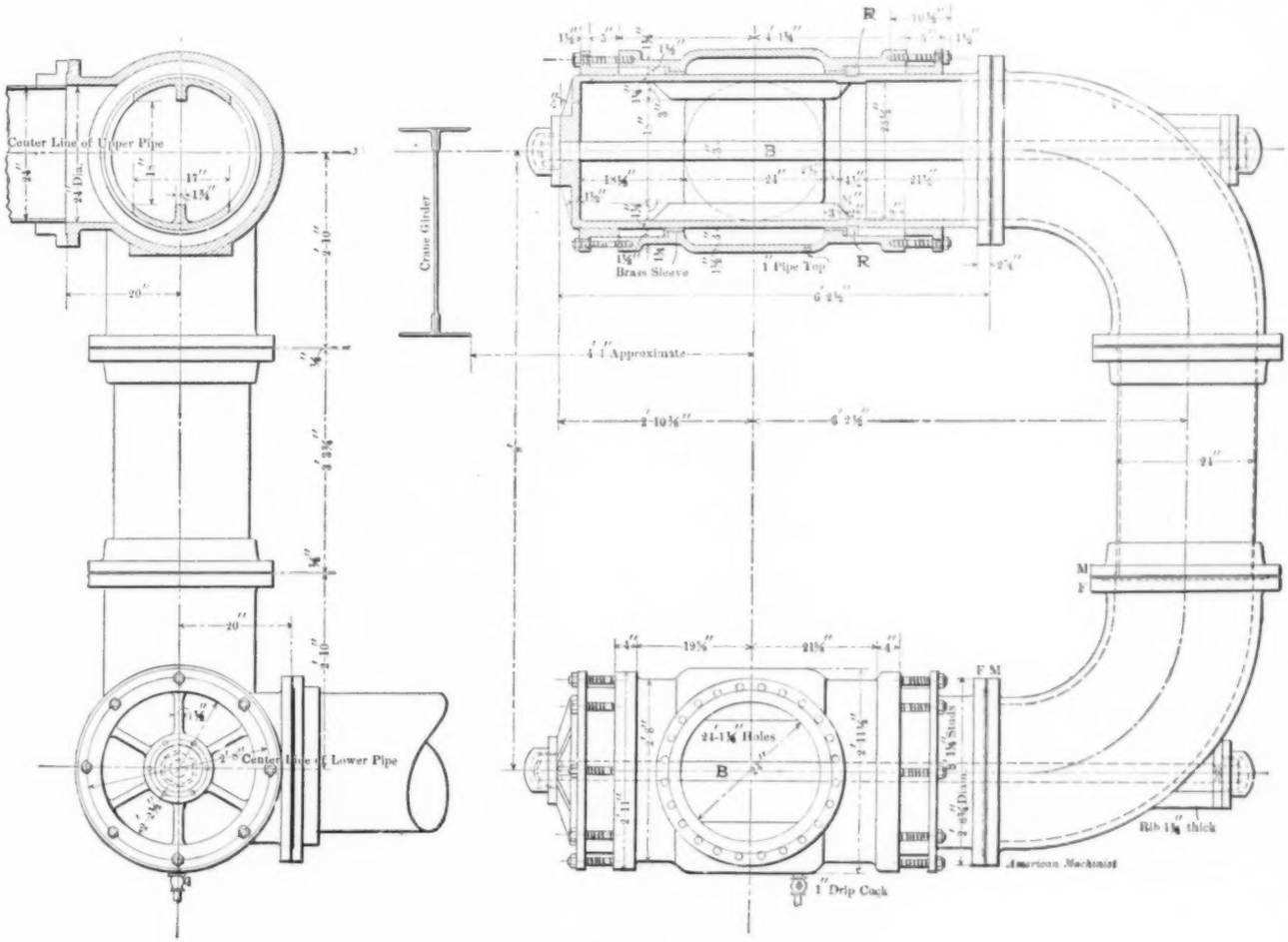
Editor American Machinist:

At page 930, Vol. 24, you published a description of an expansion which I thought at that time to be quite new. As the description referred to was followed by those of several other joints, I believe the subject to be an interesting one and a description of a 24-inch expansion joint I have since had occasion to put in will not be out of place. The joint is shown in the accompanying drawings. It was designed to connect two steam lines, one of which is 9 feet vertically above the other, and the joint is arranged to provide for the expansion of both lines.

Running parallel to the upper pipe and about 4 feet 6 inches to one side is a crane girder which prevented our making any very large connections on that side of the pipe. After considerable thought and worry, we decided to put in the joint as shown.

The plungers which swivel in the special tees on the end of each pipe require outside packings, as shown, but they give but little trouble and allow the plungers to rotate freely in the special tees. It will be seen that the steam pressure on the plungers is perfectly balanced, so there is no pressure to force them out. However, it might have been possible for the plungers to gradually work themselves out of place, and to prevent this the brass rings *R*, in halves, were put in as shown. The rods *B* seem to be unnecessary and were put in merely to prevent a wreck in case the plungers happened to be of poor castings that would give way under the steam pressure.

Some will contend that the expansion joint, as a whole, is very large and expensive; but when they consider the location of the steam pipes and the fact that the joint works without giving any trouble they will be convinced that it is not such a bad one after all. Besides, everyone must remember that a 24-inch expansion joint of any kind is no baby. ENGINEER.



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Folderol About Coal and Power.

About as much nonsense as we have ever seen condensed into a single short article we find in one that is going the rounds credited to the *Baltimore American*. The article is entitled "Power in a Pound of Coal," and is put forth as based upon the remarks of "an experienced locomotive engineer." This locomotive engineer evidently does not understand that power is simply a rate of doing work and that one horse-power may be developed from a pound of coal during a period of one hour, or 60 horse-power during a period of one minute, depending upon how it is burned and the manner of using the energy developed. He says:

"If this pound of coal could be burned completely and entirely under water, and all of its heat should go into the water, a temperature of 625 pounds of water could be raised to the hight of one foot.

"If this pound of coal could be completely burned in water one foot deep, with a temperature of 64 degrees, and all the heat from this coal be imparted in the water, this water would become 16 degrees hotter, thus being suitable for a comfortable bath. If adapted to mechanical work, the 10,000 heat units in the one pound of coal would be equivalent to 236 horse-power."

No doubt this engineer thinks that means something and no doubt many lay readers will think so and will wonder why they are not able to grasp its meaning. But the fact is it is just tommy-rot and has no meaning whatever. He goes on:

"If the power in this pound of coal is compared with the work of a strong man used to hard labor, it would be found that there is more than sufficient power in the pound of coal to do in one minute the day's work of eight hours of five strong men. This is accounted for in this way: The work of a strong man, used to hard work, is estimated as being equal to one-tenth of a horse-power. The eight hours he works is equivalent to 480 minutes. Naturally, while working, a man makes a number of stops, either to rest or change the monotony of his position. These stops, then, would without difficulty take up one-tenth of the man's time. Thus, this would reduce the time of actual work down to 432 minutes. This time at one-tenth of the horse-power, makes the total of his day's labor amount to 43.2 horse-power.

"At this rate it is shown that it would take 2,600 strong men, working constantly, to do jointly the same amount of work in one minute as can be done by the single pound of coal.

"Another line of work in which the superiority of a pound of coal is shown beside the labor of man is that of sawing wood. A man may consider himself a swift sawyer by making 60 strokes a minute, each stroke of the blade having progressed 5 feet a minute, but a circular saw, driven by machinery, may be put through 70 times that distance and saw 70 times as much wood. Still, this little pound of coal has the power to keep in operation 180 such saws."

This is, if possible, still worse, and the only thing it clearly shows is that the engineer who talked or the man who wrote the article, or both, were hopelessly, completely and blissfully ignorant of the subject. It is a pity that the slow process of educating the general public to have some conception of the fundamentals of mechanical principles must be retarded, as it is more or less, by the publication of such fanfarol.

The Harvesting Machine Trust.

The organization of the new company which has taken over the ownership of the leading manufacturing establishments of harvesting machinery in America will, we suppose, again start the talk about the oppressed farmer and the difficulty he has to contend with against the trusts. We do not deny that the farmer has his own peculiar difficulties to contend against, but this combination of the harvester machine companies is not necessarily to be an addition to them. A number of manufacturers of such machinery are not included in the combination and in any event this combination, like that of the heavy tool builders, is one which controls no monopoly of raw materials or of brains and must therefore conduct its business with either actual or potential competition in view. In other words, there will be some harvesting machinery made outside the combination and there will also be the possibility of capital being attracted to the business whenever it becomes apparent that the profits in the business owned by the combination are materially greater than can be obtained by capital invested in other lines of manufacturing enterprise. Such capital will under such conditions immediately be invested in the harvester business, the investors knowing full well that either they must be allowed to make something like the same profit on their products or that the combination will be obliged to buy them out at a fair price. There is absolutely no monopoly of capital, nor can there be. On the contrary, capital is constantly seeking channels of investment that promise fair returns and lots of it is earning to-day only about 3 per cent. per annum.

Carrying the Details.

The temporary breakdown by Mr. Schwab, president of the United States Steel Corporation, has caused some talk about the liability of men in such positions to break down, and it is being pointed out that it may be doubted whether "any one man is capable of continuously carrying all the details of such a business as that which Mr. Schwab handles." This is being cited as a possible limit to the magnitude of such companies and their operations. In our opinion, however, such views

are held only by those who are entirely unfamiliar with the management of large industrial operations. It is absurd to suppose that Mr. Schwab even tries to oversee all the details of the business of the United States Steel Corporation. He has plenty of assistants, who are as competent, if not more competent, to attend to the details than he is, and it may be assumed as quite certain that they do attend to them, leaving Mr. Schwab to attend to the larger and more general problems connected with the business. Of course, there is a great deal of responsibility in the solution of these problems as they arise and men of a certain temperament find that they are unable to continuously carry such responsibilities. Where a man realizes that his decision of a question one way or the other may mean a loss or a profit of millions of dollars he is apt to be a little nervous about it, and to worry a little after the decision has been made for fear it has not been made rightly. Where one allows himself to do this nervous collapse is imminent, but men of different temperaments carry such responsibilities with perfect ease, and wherever they break down by reason of attempting to attend to the details of a large business it simply means that such men are not fitted to carry on a large business. It is extremely unlikely that Mr. Schwab has been hampered or bothered by the details of the business of the United States Steel Corporation.

A Proposed New Co-operative Plan.

Mr. Alexander Purves, treasurer of the Hampton Institute, and a man who is referred to as having had considerable experience in business matters in a large way, proposes in a recent magazine article a new form of industrial union between employers and employees, which is receiving some attention. It is a form of co-operation, but has some features entirely different from the ordinary co-operative organizations. The plan has been described in brief as follows by the New York *Times:*

"He suggests a plan substantially as follows, though it is obviously impossible to give a clear and full statement of it within the limits of a newspaper article. He reserves to the Board of Directors all right of management, direction and administration, including the employment and discharge of labor. An agreed share of the net profits is to be set aside for the primary compensation of capital, the share being put tentatively at 60 per cent. In a concern of $1,000,000 capital, earning an average of $200,000 a year, this would amount to $120,000. Of the remaining $80,000, 20 per cent., or $16,000, annually is put aside as a contingent fund to meet extraordinary losses and for other purposes which he defines. The balance, $64,000, is devoted to what he calls deferred stock debentures, one-half for the owners of stock and one-half as extra wages to be paid to all employees, of whatever grade, in the ratio of their wages. The dividends on common and preferred stock are to be cumulative. If the profits of any one year do not provide them, they are to be made up in later years before the deferred stock debentures are issued. The holders of the debentures are, then, entitled, first to interest at not exceeding 6 per cent. on the issue for any one year; second, to additional debentures each year for the amount remaining from profits after paying dividends and the contingent fund, or to the cash if the capital cannot be used in the business; third, to the right to purchase new stock if issued, in the proportion of their holdings.

"In substance, this is a plan for investing in the business for the benefit of employees the profits remaining after paying capital its share and providing for contingencies. The holders of debentures would not have any vote in the management of the business, but would be able to increase the net profits in which they share by their own fidelity. As the stockholders have the same interest in the debenture fund as the employees have, it is inferred that this fund would be fairly computed and created. It is proposed that the debenture fund shall be placed in the hands of a trustee who shall have a right to full knowledge of the affairs of the concern and to examination of the books. While there may be objection to this feature, Mr. Purves regards it as of importance for the reason that it secures adequate knowledge to the employees of the share they are really getting in the business to which their labor is contributed, and this, he thinks, is sure to be a source of contentment, harmony and corresponding increase of efficiency."

Examinations for Positions.

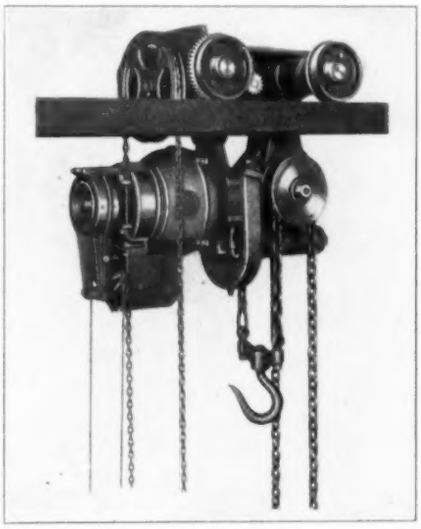
The Municipal Civil Service Commission, 346 Broadway, New York, gives notice that a competitive examination will be held, September 3, for a mechanical draftsman for a position which will pay a salary not exceeding $1,200 per annum. At the same place, and on August 29, a competitive examination will be held for position of electrical engineer, which position will be in the fire department and will have the title of "Superintendent of Telegraph." The salary will be $3,000 per year. At the same place on Friday, August 22, a competitive examination will be held for Inspector of Iron and Steel, the salary of which will be from $1,200 to $1,500 per year. Full information can be obtained by addressing S. William Briscoe, secretary, at above-named address.

The eighty-third meeting of the American Institute of Mining Engineers will begin October 14 at New Haven, Conn. The secretary's address is: R. W. Raymond, 99 John street, New York city.

Some New Things.

NEW ELECTRIC HOIST.

The illustration shows an electric hoist brought out by the Sprague Electric Company, of New York. It is designed for rapidly handling work in machine shops, foundries, etc., and is operated from the floor. The motor and hoisting mechanism are shown attached to a trolley, but, where hoisting and lowering motions only are desired, it can be hung from a strap. The smaller sizes can be equipped with a trolley arranged to run on a single rail or I-beam. A standard Lundell round type motor is used and as the motor and gearing are enclosed in a water-tight and dust-proof casing, the hoist may be operated outdoors. The worm hoisting gearing runs in an oil bath and all bearings are self-acting. The motor is operated by a



ELECTRIC HOIST.

cylinder type reversing switch and is equipped with a powerful brake which is opened by the movement of the switch. The switch and brake are operated by the cord shown at the end of the hoist. In lifting there is but one speed for a given load. In lowering there are two speeds. The trolley is moved along its track by means of the chain running on the sheave at the top. When the hoist is to be used on the bridge of a crane, a trolley can be supplied equipped with a reversing speed regulating controller to be connected with a bridge travel motor. This controller is operated by cords suspended near the cords that control the hoisting motor. With this arrangement all three movements—the travel of the bridge, the cross-travel of the trolley, and the hoisting—are readily controlled by the operator who is standing near the load.

International System Screws in the French Navy.

At a meeting of the French Society for the Encouragement of National Industry, held recently, the Minister of Marine announced that, following the recommenda-

tions made at the congress held at Zurich in October, 1900, as to the adoption of an international system of screw gages, he had with the concurrence of his technical advisers, decided to render the new system a service regulation so far as it concerned the heads and worms of screws. He had accordingly given instructions that for all sizes used in the French Navy the length should be made equal to 1.4 diameters plus 4 millimeters ($L = 1.4d. + 4$ mm.)—*The Engineer.*

[We must confess that we don't know what the above item means, but perhaps some of our readers can enlighten us.—Ed.]

Hospitals for Employees.

It is announced that a hospital for emergency cases is to be established at each of the twenty-two plants of the American Steel & Wire Company, at a total cost for buildings and equipment of not less than $300,000. The determination was arrived at as the result of a year's trial of one hospital. The buildings, which will be as nearly alike as circumstances will permit, will be two stories high, with baths, sitting-rooms, library, dining-room and sleeping apartments for the nurses, with quarters for six beds. There will be a dispensary for employees who may need medical attention or who are not so seriously injured as to need to become inmates of the hospital. Six nurses, two druggists and an ambulance service will be provided for each hospital in addition to the regular physician. There are three plants of the company in Pittsburgh, one each in Allentown, Pa.; Joliet, Ill.; Cleveland, O.; Fall River, Mass.; Detroit, Mich., and the others are scattered throughout the East.

A Patented Molding Process.

We here reproduce, practically complete, the specification of a recently issued United States patent for a process of molding and casting which should be of interest to a large number of our readers. We are by no means here guaranteeing the entire novelty or the practicability of the process described. It at least embodies a suggestion and is certainly deserving of consideration, discussion and criticism. The specification is as follows:

"My invention consists of a molding process, as will be hereinafter fully described, and is designed to overcome certain objections present in the process usually practiced in foundries at the present time, in which a permanent pattern, usually of wood, is first constructed and by which a mold is made. This generally necessitates the dressing of the mold, as well as in most cases the dressing of the casting, to remove, for example, the fins made at the parting line of the mold. It is also obvious that in foundries where an order for a large number of the same articles are to be filled, considerable time is necessary to produce the number required, or it is necessary to produce a large number of these permanent patterns, which would also necessitate a large number of flasks, etc., and time in making the molds and ramming the same. To overcome these and other objections found in the existing process of casting, I propose, first, to provide a master-mold of the article to be cast and then to produce from this mold patterns composed of material that is fusible—for instance, at a comparatively low temperature—for example, rosin or other materials of like nature. In this way a large number of patterns can be quickly produced from this master-mold, which is the only one that requires the skill of a patternmaker in producing.

"In carrying out my process I perform the following steps, namely: First, I produce a master-mold and then cast a fusible pattern by pouring into this mold fused material to produce the necessary pattern, it being understood that, as before stated, any suitable material can be employed, but which when hardened can be removed from the mold and handled. Then after this pattern hardens it is removed and embedded within suitable molding material, such as molder's sand, and which is packed around it in the usual manner and is not handled thereafter nor disturbed. Then I heat the pattern to a molten state and by means of an opening or channel made through the surrounding mold removing the material composing the pattern therefrom. After all the material composing the fusible pattern is removed from the mold the metal from which the article is to be cast is introduced and after hardening is removed as a complete and finished casting, because, except for the header thereon or a portion thereof, there are no projections on the casting—such as, for instance, is formed usually at the parting line of the mold. Thus it will be seen that any number of patterns can be cast in this master-mold, and, furthermore, that the material used in the pattern can be used over and over.

"It is understood that it is necessary to have some opening through which the fusible pattern can be removed from the mold and through which the molten metal can be introduced; but in referring to a header I contemplate the header employed in casting articles of steel. These headers are of considerable size and designed not only to permit the molten metal to be poured into the mold, but to form a reservoir or head in which the molten metal will stand during the cooling of the casting, so that as the metal within the mold cools and contracts the molten metal still contained in the header will supply sufficient molten steel thereto to produce a perfect casting, and my invention therefore contemplates the construction of a master-mold with or without the header to which I have last referred, as desired.

"Thus it will be seen that I provide a molding process by means of which I can cast any number of uniform patterns, with which a series of molds may be produced to cast any number of uniform articles without fins or inequalities, etc., and in which skilled labor in producing the original mold only is required. After this mold is finished any number of articles can be cast without waste of material or the necessity of other labor than pouring the fusible metal therein, removing the fusible patterns and embedding them in molding material to make a series of molds, removing the pattern in a molten state, and, finally, pouring in the metal. In this master-mold any number of patterns may be cast, and it is obvious that they will be counterparts of each other in every detail, and in this way I obviate skill in the production of anything except the master-mold."

The patentee of the above described process is Frederick Baldt, Sr., Chester, Pa.

The Park Oil Company is the latest name we have heard for the Cleveland oil swindlers who are so continuously and lamentably unfortunate with their shipments of oil and which they therefore desire to dispose of at very low rates.

In connection with the sale of an automobile plant on Jersey City Heights, it was announced by the receiver's attorney that the depression in the selling price of automobiles had made the outlook of the creditors of the concern very unfavorable, the price for machines having dropped 50 per cent. This will be a surprise to most people who have given any attention to the automobile business; the general impression being that the prices of automobiles are, and have for some time been, on an ascending instead of on a descending scale.

At page 1013 we illustrated a cold-saw machine, built by Gustav Wagner, Rentlingen, Wurtemberg, for cutting off beams. The maker writes us that in recent tests made with this machine beams 400 mm. high were cut off in 3 minutes, and beams 500 mm. high in 5 minutes.

A daily paper gives an account of a new water wheel which has been invented and which is to be used by a water motor and power company, which company is said to be preparing to furnish power for a number of cities. Speaking of the water wheel, the account says the device, "unlike most water wheels, does not depend upon the the hight of the fall at the point of the stream at which it is to be operated as much as it does upon the weight and volume of the water." This is interesting, but what it means is a problem about equally interesting.

Secretary of the Treasury Shaw has ordered that letters hereafter shall be acknowledged on the same day they are received. If they cannot be answered fully, acknowledgment will be made, and upon investigation a complete reply will be forwarded at the earliest possible moment. Business is to be conducted according to modern business methods; if a private business was not so conducted, it would suffer.

A paper which has been printed by the Institution of Civil Engineers of London and entitled "American Workshop Methods in Steel Construction," by Henry Bridges Molesworth, M. Inst. C. E., will be found very instructive and entertaining. Mr. Molesworth, whose paper we have previously referred to, and who spent some time in inspecting work at the Pencoyd Iron Works, had an unusually good opportunity to study American methods. He made good use of his opportunity and his paper simply describes what he saw, and calls attention to the difference between American and British practice. In the discussion which followed the presentation of the paper many interesting things are set forth. Most of the members who took part in the discussion commended the paper, recognized the fact that it dealt with hard facts noted by a competent observer and were disposed to give due weight to them. The inevitable insular specimen was present, however, who attempted to discredit or belittle every statement made by Mr. Molesworth and to deny that there was any possibility that anything whatever could be better, anywhere in the world, than in British shops.

"We Haven't Got Them Castings."

In most manufactories it sometimes happens (in some factories frequently) that the assembling department runs "short" of some one or more castings, somebody having failed to be sufficiently forehanded in the matter of keeping account of stock. Whereupon consternation seizes upon the responsible party, and he rushes to the foundry, demanding "Why ain't we got them cast'n's?"

The question is shot at the startled foundry foreman with a vehemence that repudiates all possibility of blame attaching to the questioner, and a plain intimation that the foundry has "fallen down" at that point. But the founder produces his books and shows that "them cast'n's" have been delivered daily according to schedule.

"Well, something's the matter—they must have been shipping 'extras' without reporting—give 'em to us as quick as you can, Bucks—how many can you get in today?"

To which Bucks replies: "The blast will go on in about half an hour; besides, the cores must be made and dried; so it will be impossible to get much more than the regular quantity to-day."

Whereupon our friend from the assembling room proceeds to—metaphorically—"throw himself into the breach" by suggesting a number of plans by which, he thinks, to-day's product of this particular casting could be materially increased.

"Put a second molder on 'em, Bucks."

"But we have no extra cores."

"Hang the cores! We'll drill 'em."

"But we have only one pattern."

"Hey?"—(getting somewhat dazed).

"I say we have but one pattern."

"Oh!"—(returning lucidity, but not exactly pellucid).

"Besides, I don't believe you have any tools for drilling square holes, have you?"

"That is so!—them holes is square!—gee whiz!"—(rational, almost).

I really felt sorry for the fellow. They would run out of these castings some time during the next day, and the prospect of an angry Smith was not pleasing to him.

Next day, about 10 o'clock, Smith broke into the foundry, and I could see by the swing of his gait that it needed oil. He came up with—"Say, Bucks, what about them B. K. number four hundred 'n' 'lev'm spreaders? Limpy says he's ben chas'n after 'em f'r a week past 'n' can't git 'em fast enough."

I told Smith just how the matter stood; that Limpy's first request for an increase was made the day before, just a little before "blast time," too late to do any good for that day.

He left, muttering as he went, and, I felt sure, with no very clear understanding of the case as I had explained it to him.

Well, next morning at 7 o'clock a message came to the foundry asking for "them B. K. spreaders."

I answered that they were in the foundry, and would be put into the tumbling mill at once.

A half hour later Smith came in and wanted to know if they were "going to get any more of them B. K. spreaders this summer!"

I told him that I would send them over as soon as they were cleaned, ground and inspected.

"But we've ben hollerin' for 'em for a week past—where are the ones you made yesterday?"

I answered that they were the ones that would be delivered to-day.

"But what about the ones you made day before yesterday?"

I reminded him that the order for the increase was not given till day before yesterday, and, in short, had to go through the whole rigmarole with him again.

During this colloquy a boy from the assembling department handed me a slip of paper, and, glancing at it, I read:

"Mr. Bucks—Have found a lot of B. K. spreaders—covered up in a bin. All O. K. now; need not increase. L."

"The lady, or the tiger?" In other words, did I show that slip of paper to Smith, or did I not?—*"Mr. Bucks," in The Tradesman.*

Commercial Review.

NEW YORK, Monday, August 18.

Manufacturers of heating and ventilating appliances find a large amount of business awaiting their attention nowadays. This is the time of the year when articles of this character are installed, and concerns engaged in their manufacture report an unusual large number of requests for bids. The demand is especially heavy from public and office building centers. At the New York offices of the B. F. Sturtevant Company, of Boston, Mass., some good orders for complete mechanical heating and ventilating equipment have been received for installation in this city. Among them are for the following buildings in course of erection, viz., the Stock Exchange building in Broad street, the Hall of Records building in Chambers street, and the Astor Hotel at Fifth avenue and Fifty-fifth street.

Since the selection of the Panama route for the Isthmian Canal there has been considerable speculation as to whether or not all purchases of the necessary machinery and supplies would have to be made in France, which was a restriction placed on the old Panama Canal Company by a French law passed in 1888. An eminent firm of New York lawyers has handed down an opinion in the negative. Among other things the opinion states: "No law of France could bind the United States, in any case, outside the limits of France itself, but this act does not even profess to do so. The United States is a mere purchaser of the property of the new Panama Canal Company. It acquires nothing from the French Government and is under no obligation to it. The obligation to use material of French origin was personal to that company. We may observe that the Isthmian Canal Commission considered the machinery now on the isthmus, while in good condition, to be out of date and of no real value. It is obvious, therefore, that an enormous amount of machinery will be required for the completion of the canal, and there can be no doubt that the government will purchase this in the United States."

The International Harvester Company, which was recently organized with a capital of $120,000,000, and which comprises some of the largest manufacturers of agricultural machinery in the country, will probably concentrate its entire plant in Chicago, adjoining the McCormick Harvesting Machine Company, one of its chief constituent concerns. Some 200 acres of land recently purchased adjoining the plant of the McCormick Company, is supposed to be with that purpose in view. One of the directors of the new company, speaking of its operations, says:

"The company is capitalized upon an exceptionally conservative basis. Of its assets $80,000,000 are in cash working capital. The company will require no financing and there will be no offer of its

stock to the public, all the cash required having been provided by its stockholders. It is the expectation of the company that through its large manufacturing facilities and ample cash resources it will be able to continue the manufacture and sale of agricultural machinery without having to increase prices.

"It is well known that the prices of raw materials used in the manufacture of harvesting machinery have steadily advanced during the past few years, and although the manufacturers have hitherto avoided an advance in the price of their products it has become apparent from the existing conditions that higher prices would soon become a necessity unless the methods of manufacture and business could be materially improved and large economies accomplished. The manufacturers realize that their welfare and the interests of the farmers are identical. The United States, through its fertile fields, labor-saving machinery and cheap transportation, has become the leading food-producing country of the world. An advance in the prices of agricultural machinery would injure the farmers and react upon the manufacturers; but, on the other hand, if existing conditions continued, an advance in prices would be inevitable. It thus became necessary either that prices should be advanced or that substantial economies should be effected in the manufacture and distribution of agricultural machinery."

When one comes across an advertisement in a daily newspaper offering to rent residential and business property of all kinds, or any conveyance adapted for use either on land or sea, there is no reason why any surprise should be expressed. It is a different matter, however, when an advertisement appears offering to rent machinery of all kinds, yet advertisements of this character are occasionally found in prominent newspapers. The reasons which would prompt a person to rent property and conveyances are too obvious to enumerate. But in the matter of renting machinery, it is easy to see how it could be made profitable for the owner of it to do so, provided customers could be obtained. It was for the purpose of acquiring information on this point that the writer approached a person engaged in the business. The latter said that his customers, for the most part, were contractors, who were given certain work to do necessitating the use of machinery, which required usually only a short time to execute, and which didn't justify the purchase outright of either new or second-hand machinery. He added that he referred to small contractors, as the larger contractors always bought their machinery outright, because it formed as necessary a part of their plant as anything that could be mentioned. Discussing the financial part of his business, the writer's informant said that two things entered into it, viz., the class of machinery wanted and the period for which it was required. He stated that he could give better terms on pumps and hoisting engines, because they comprised the major portion of his stock. The customary rent charged for 10-inch stroke pumps, for example, he said, was $1 per day, and for ordinary hoisting engines $3.50 per day. When the writer asked him what he would rent a 10-inch stroke pump for six months, he was told that it would be cheaper to buy the pump, an assurance that did not call for mathematical demonstration. It is evident that second-hand machinery dealers have competition from other sources beside the manufacturers.

The New York, New Haven & Hartford Railroad is installing considerable woodworking machinery in its new shops at Readville, Mass. All of the orders have not been given out yet, but the majority that have were given to the J. A. Fay & Egan Company, of Cincinnati, O., and S. A. Woods Machine Company, of Boston, Mass.

The contract for the entire mechanical and electrical equipment of the new plant at Philadelphia of the Crompton & Knowles Loom Works, of Worcester, has been placed with Sargent, Conant & Co., of Boston. Power for the entire works will be transmitted and distributed electrically.

Orders for Westinghouse gas engines recently received are: Consolidated Industries Company, Batavia, N. Y., two 250 horse-power horizontal two-cylinder tandem double acting, one 85 horse-power vertical three-cylinder, one 35 horse-power two-cylinder; Zanesville Electric Company, Zanesville, Ohio, one 85 horse-power vertical two-cylinder gas engine; Kelly & Jones, Pittsburgh, Pa., one 125 horse-power vertical three-cylinder gas engine direct connected to generator for power purposes; H. Garrison Foundry Company, Pittsburgh, Pa., one 125 horse-power vertical three-cylinder; Mingo Junction Water Company, Mingo Junction, Ohio, one 125 horse-power vertical three-cylinder.

The Waterbury Farrel Foundry and Machine Company have opened a branch office in Cleveland, Ohio, which will be in charge of George R. Lamb.

On account of the rush of business, and to obviate the necessity of operating at night, The S. Obermayer Company, of Cincinnati, Chicago and Pittsburgh, manufacturers of foundry facings, supplies and equipments, have let contracts for an additional factory building to the Cincinnati plant. The extra addition will be a three-story brick building, 60x90 feet, and will increase the capacity of the Cincinnati plant about 33⅓ per cent. The general offices of this company are at Cincinnati, Ohio.

It is stated that the Philadelphia Pneumatic Tool Company will increase its capital stock to $2,000,000 in order to take care of its rapidly growing business and to prosecute extensions of it into all parts of the world. Its plants are running night and day to keep up with orders. The increasing demand for the Keller rotary drill is a particularly noticeable feature in this company's business. Four of the large Eastern steel companies have recently purchased Keller tools to the aggregate number of 237. One of the Western trunk line railroads has recently made a contract with the company to purchase at least 1,500 Keller tools within the next eight months. A cable order for Keller tools was received last week from Bilbao, amounting to several thousand dollars.

The opening by the Government postal authorities of bids on August 15 for the rental of pneumatic tube service for the fiscal year 1903, in New York, Brooklyn, Boston, Philadelphia, Washington, Chicago and St. Louis exceeded the sum appropriated for the purpose, which is $500,000. No awards will be made until some adjustment is effected among the different cities to come within the appropriation. The companies that submitted bids were the New York Mail and Newspaper Transportation Company (the only company bidding for the New York and Brooklyn service), Pneumatic Transit Company, American Pneumatic Service Company, Chicago Pneumatic Service Company, Pneumatic Service Company, and the Batchellor Pneumatic Tube Company. The bids per mile showed a wide discrepancy, averaging from $15,180 to $29,154, according to the route and the line dimensions.

CHICAGO MACHINERY MARKET.

No better indication of the general prosperity of manufacturers of machine tools and concerns operating machine shops in connection with their establishments is to be found than in the increasing number of firms installing electrical machinery for the operation of their plants. Makers of electrical equipment all report that the demand for motors and generators has shown a greater increase within the last six months than in any like period of any preceding year. Few are able to make deliveries within two to four months, notwithstanding that all of them are operating their plants to the utmost limit and many engaged in making large extensions to their capacity. The business during July and August has been particularly good, none of the manufacturers reporting any falling off in sales as a result of the hot weather. No very large installation or orders are reported, the bulk of the business coming from a widely scattered area and for individual motors and generators.

The growing popularity of electrical machinery is shown in an order received by the Chicago office of the Crocker-Wheeler Company, of Ampere, N. J., from the Sawyer & Austin Lumber Company, Pine Bluff, Ark., for one 250-kilowatt generator and for motors of various sizes aggregating 350 horse-power. This electrical machinery is to be used not only for lighting purposes, but for the operation of the company's sawmills, and is probably the

first installation of this kind made in that section of the country for such purposes. The company reports that lumber manufacturers have shown great interest in electrical equipment of late, and that it has several deals pending with other sawmills. Some of the orders which the Crocker-Wheeler Company has received through its Chicago office are as follows: McCormick Harvesting Machine Company, Chicago, one 300-kilowatt engine-type generator and two 250-kilowatt belted machines; Grand Crossing Tack Company, Grand Crossing, Ill., one 300 and one 100-kilowatt engine-type generators, for use in the company's new plant at South Chicago; Buda Foundry & Manufacturing Company, Harvey, Ill., one 250-kilowatt engine-type generator; Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio, for its new shops, one 300-kilowatt engine-type generator; Minneapolis Steel & Machinery Company, Minneapolis, Minn., bridge builders, entire equipment of generators and motors; Patton Paint Company, Milwaukee, Wis., for its new shops at Newark, N. J., entire equipment of generators and motors; Pittsburgh, Lake Erie & Western Railway, for shops at Pittsburgh, entire equipment of motors and generators, including multiple voltage system for varying speed of machine tools; Sawyer & Austin Lumber Company, Pine Bluff, Ark., one 250-kilowatt engine-type generator and motors of varying sizes aggregating 350 horse-power; American Car & Foundry Company, for shops at Madison, Ill., one 200-kilowatt engine-type generator; Pennsylvania Iron & Coal Company, Canal Dover, Ohio, two 200-kilowatt engine-type generators; Parke, Davis & Co., Detroit, two 200-kilowatt engine-type generators.

The Milwaukee Electric Company, through its Chicago office, has made sales in the past week to the Chicago, Milwaukee & St. Paul Railway, for installation in its shops at West Milwaukee, of two 200-kilowatt generators of engine-type direct-connected to Corliss engines making 100 revolutions per minute; Blue Flame Stove Company, Kankakee, Ill., complete electrical equipment, including motors and generators, and to the Buda Foundry & Manufacturing Company, Harvey, Ill., a second equipment consisting of fifteen to eighteen large motors, for use in its machine shop.

Quotations.

NEW YORK, Monday, August 18.

Pig iron for immediate delivery is becoming scarcer with the passing of each day. Buying for 1903 delivery continues good, with No. 2 Southern foundry the feature, at $17.50 @ $18 at the furnace. New York prices for this year, mostly nominal, are as follows:

Northern:

No. 1 X	$23 50 @ $25 00
No. 2 X	22 75 @ 23 50
No. 2 plain	22 25 @ 22 50

Southern:

No. 1 Foundry	22 00 @ 23 00
No. 2 Foundry	21 75 @ 22 50
No. 3 Foundry	21 25 @ 22 75
No. 4 Foundry	20 25 @ 21 25

Bar Iron—Base Sizes—Refined brands, mill price on dock, 1.93c. upward in carload lots. Smaller quantities from store, 2.15 @ 2.20c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 11⅞ @ 12c.; electrolytic and casting, 11½ @ 11¾c.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, 28¼ @ 28⅝c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—5⅜ @ 5½c.

Antimony—Cookson's, 10c.; Hallett's and U. S., 7¾ @ 8c.

Lard Oil—Prime City, 82 @ 85c., according to brand and quantity ranging from one barrel up to large lots.

Manufacturers.

The Grafton (W. Va.) Foundry & Machine Works are soon to build.

The plant of the Erie (Pa.) Forge Company, Ltd., has been burned.

The Phoenix Knitting Works, Milwaukee, Wis., have been damaged by fire.

The Kalamazoo (Mich.) Stove Company is contemplating doubling its foundry.

The C. Turner Company, Chicago, Ill., soap manufacturer, will build a new plant.

An addition is to be built to the Derby Cotton Mills of R. F. Adams, at Shelton, Conn.

A new building will be built by the Pueblo (Colo.) Macaroni Factory and new machinery added.

Nolde & Horst Company, hosiery manufacturers, Reading, Pa., will build an addition to its factory.

The Slater Cotton Company, Pawtucket, R. I., is about to construct a new boiler and engine room.

A new plant at Wyncote, Pa., is to be built for the Montgomery County Ice & Cold Storage Company.

The Craig Foundry Company, of Toledo, Ohio, is enlarging its plant at a place called Birmingham.

Henry M. Christensen, manufacturer of razors and cutlery, Campello, Mass., will erect a new factory.

Rome, Ga., hopes to have a $100,000 car plant. Captain John J. Seay, of that place, has the matter in hand.

Plans have been prepared for additions to the factory of the Fox Machine & Typewriter Company, Detroit, Mich.

Work has begun on a new machine shop for the Warren Steam Pump Company, Warren, Mass. It will be 150x85 feet.

The James E. Thomas Company, of Newark, Ohio, is arranging to build an iron foundry at a cost of about $100,000.

A Chicago building permit has been granted for a foundry for the Deering Harvester Company; estimated cost, $80,000.

Swift & Co., the meat people of Chicago, are said to be intending to build a wool-pulling plant at Lowell, Mass.

The brass works of the McNab & Harlin Manufacturing Company, Paterson, N. J., are to be increased by two buildings.

A rolling mill is to be built at Kansas City. D. M. Estey, of Owasso, Mich., is associated with local capital in the enterprise.

The Bryant Lumber & Shingle Mill Company, of Fremont, Wash., has taken out a permit to build a small machine shop.

The Cleveland (O.) Furnace Company is procuring land for a $1,000,000 furnace plant. It will have a total of about 175 acres.

The D. E. Makepeace Company, manufacturing jeweler, Attleboro, Mass., will enlarge its plant. Machinery is now arriving.

The New Castle (Pa.) Forge & Bolt Company will make extensions and improvements, and 125 men will be added to the payroll.

The Cocheco Manufacturing Company, print cloths, Dover, N. H., is to build a new power plant of 10,000 horse-power, it is reported.

A factory, 56x119 feet, three stories, will, it is understood, be built for Patrick Carroll, manufacturer of bath boilers, Philadelphia.

Bids will be received at Brenham, Texas, September 4, for the construction of a cotton mill plant for the Brenham Cotton Mill Company.

The Snell Manufacturing Company, of Snellville and East Brimfield, Mass., manufacturer of augers, bits and screwdrivers, is making additions.

The Bristol Company, manufacturer of recording instruments, steel belt lacing, etc., Waterbury, Conn., is having a new boiler-room built.

The Pintsch Compressing Company, New York city, will build a gas manufacturing plant at Nashville, Tenn., to supply trains in that region.

Williamson Bros. Company, machinist and boiler manufacturer, Philadelphia, Pa., is, it it understood, having plans prepared for a factory building.

The C. M. Kemp Manufacturing Company, plumbers' specialties, Philadelphia, Pa., has taken out a contract for a three-story factory building; cost, $9,000.

A $110,000 municipal electric light plant is proposed to be erected at once at Columbus, Ohio. Secretary Addison, of the Board of Public Works, will call for bids.

The Citizens' Gas & Coke Company, Findlay, O., has begun the erection of an $80,000 artificial gas plant. E. H. Evans, of Chicago, is constructing the new plant.

Work has begun on the excavations for the new factory of the T. W. McClelland Company, planing mill and manufacturers of sashes, doors and blinds, Davenport, Iowa.

It is understood that the Big Four will build a machine shop at Springfield, O., in the spring, and that work would have begun on it this summer, but for the difficulty in getting steel.

The Burden Iron Company, Troy, N. Y., manufacturer of nails and horseshoes, is adding a new rolling mill with gas furnaces and generating service as well as new blast furnaces.

The Washington, Baltimore & Annapolis Electric Railway Company has bought two acres of ground in East Hyattsville, Md., upon which the power-house for the projected line will be erected.

The contracts have been let for a machine shop, 50x150 feet, to be built at Albany avenue and West Twenty-fifth street, Chicago, Ill., for the Western Foundry Company, at a cost of $12,000.

The Toledo (O.) Wire & Iron Works Com-

pany, of which F. Powell & Co. are proprietors, has secured a site for a new factory. According to the interesting story of a local newspaper, "the main building will cover 100 square feet of ground."

Harry Giessel, of Chicago, superintendent, and Mr. Krein, of St. Marys, O., have located a new factory to be erected at once in Wapakoneta, O. Among the specialties this factory will put out are acetylene gas generators, adjustable elbows and water filters.

The capacity of the Louisville & Nashville Railroad shops at New Decatur, Ala., is to be almost doubled. These shops now employ nearly 1,600 men. The company will manufacture car axles there and about everything in connection with a car except the wheels.

The plant of the Troy Steel Company, situated on Breaker Island, Albany County, N. Y., and in Troy, Rensselaer County, has been sold to satisfy a judgment to A. F. Donovan, of St. Louis, at $525,000. Mr. Donovan said the plant would be operated again within a short time.

Several capitalists of Elyria, O., chief of whom is Mr. Miller, have determined to erect a steel tube mill there with a capital of $200,000. Some of the machinery has already been purchased, and work is now delayed because of the inability of the company to procure structural iron.

It is reported that Cornelius Vanderbilt, William A. Reade, of the New York banking firm of Vermilye & Co., and other Eastern capitalists have purchased 20 acres of land in Chicago Heights, on which they will erect buildings for the manufacture of a general line of chemicals.

Parke, Davis & Co., Detroit, Mich., the well-known manufacturers of drugs and chemicals, are making extensive improvements and additions to their electrical, steam and power plant, the work being done under the direction of George W. Scott, consulting engineer, The Rookery, Chicago.

The Toledo (O.) Railways & Light Company intends to build new car shops and storage sheds. The main building will be 117x400 feet. It is proposed to have an amusement hall for employees, with a seating capacity of 600, provided with games and eventually with a gymnasium.

The Sigourney Tool Company, Hartford, Conn., has awarded a contract for the erection of a new factory building. The company has recently erected a new boiler plant. A part of the new factory will be occupied by the Smyth Manufacturing Company, which makes bookbinders' machinery.

At Pottsville, Pa., the Eastern Steel Company is dismantling the old property of the Pottsville Iron & Steel Company, preparatory to introducing $1,000,000 improvements and has started the remodeled machine shop. The company thus far is employing 150 hands, but will increase this force to 1,200 within twelve months.

Adamite Abrasive Company, of Valparaiso, Ind., has bought a large site in North Tonawanda, N. Y., and will build a factory there for the manufacture of emery wheels and other emery wares. It will import its ore from Austria by way of New York and the Erie Canal. The plant will be operated by electricity from Niagara Falls.

It is announced from Chattanooga, Tenn., that J. H. Hornaday, of Cincinnati, and Charles A. Weller, of Philadelphia, have acquired 40,000 acres of land at the terminus of the Jellico Railroad, and a company to be known as the Jellico Slate & Iron Company is being organized with a capital of $1,000,000 for the purpose of developing it.

The contract for the silk manufacturing plant which Joseph Loth & Son, of New York, are to erect in Norwalk, Conn., has been awarded to the H. Wales Lines Company, of Meriden. The main part of the plant will consist of four brick buildings, placed so as to make a hollow square, 225x225 feet. The plant will have a capacity for the employment of 500 operatives.

The Cardella Self-Acting Pump Company, of Battle Creek, Mich., has been organized with a capital of $250,000. A factory will be erected at Battle Creek at once. The officers are: Chairman, Alexander S. Cardella, Chicago; vice-president, Wesley Leasor, Kalamazoo; secretary, J. L. Hooper, Battle Creek; treasurer, A. Mort Slay, Battle Creek; director, E. J. Hooper, Battle Creek.

Westinghouse, Church, Kerr & Co. announce the removal of their New York office from the Havemeyer Building, 26 Cortlandt street, New York city, to the Maritime Building, Nos. 8 to 10 Bridge street, opposite new Custom House and near Bowling Green. The change is the result of a largely increased business, and the new quarters will afford about double the floor space available in their present location.

New York, Pennsylvania and Ohio capitalists, headed by George W. Ireland, of Philadelphia, are reported to have purchased a tract of 350,000 acres in Santiago province, Cuba, to raise sea island cotton. The company, known as the George W. Ireland Land Company, will have headquarters in Philadelphia. Four million dollars will be spent in improvements and the cotton will be manufactured on the plantation.

A new paper company is to erect a paper mill at Millers Falls, Mass. It has organized with the following officers: President, E. P. Bragg; treasurer, C. H. Hemingway; directors, the foregoing and William McCorkindale, T. H. Fowler and Charles P. Randall, all of Holyoke, Mass. The machine will be a 72-inch cylinder one, but the contract for this and most of the other machinery had not at the time of the report been let, although boilers had been ordered.

At a meeting held in the office of Walter F. F. Ritchie, of Lima, O., it was decided to organize a glass company to manufacture telephone insulators, etc., at Toledo. The factory site will comprise 33 acres, and 500 men will be employed at the start. The output is expected to be taken by the Central Construction Company, which is building independent telephone lines. It is proposed to maintain a sand quarry, probably near Sylvania, in connection with the enterprise.

The contract for the building of the Ross rifle factory, to be established in Canada, as previously mentioned, has been awarded to Alexander Cummings, Quebec. It stipulates for a main building, three stories, 200x45 feet, with a wing 40x40. The general manager of the company, J. A. Bennett, is now residing in Quebec. The company is under contract with the Canadian Government to fill an order for the standard rifle which, according to decision, is to be adopted by the Militia Department.

When the addition to the American Waltham Watch Company's factory, Waltham, Mass., is completed the plant will present over half a mile of continuous structure facing Crescent street. An addition which is among the improvements will be occupied by the enlargements of departments in the north wing, the flat steel, mainspring, packing, plate and pinion room, and will be equipped with a large number of automatic machines. The addition to the force of employees necessitated by the enlargement of the plant will be about 400.

The board of trade at Saginaw, Mich., is in correspondence with the Standard Motive Power Company, of New York city, with a view of locating a plant at Saginaw to manufacture locomotives. The factory is proposed to cover about 33 acres of land, and consist of about fifteen different buildings. Among these the largest are: Two erecting shops, 250x80 feet; a machine shop, 350x80 feet; a paint shop, 200x80 feet; two car shops, 200x80 feet; a blacksmith shop, 300x80 feet; a large boiler shop, 500x80 feet; a large foundry, 150x80 feet; several smaller boiler shops, foundries and storehouses.

The International Harvester Company has been incorporated in New Jersey with $120,000,000 capitalization. It is a merger of the following agricultural machinery manufacturing companies: McCormick Harvesting Machine Company, Deering Harvester Company, Piano Manufacturing Company, Warder, Bushnell & Glessner Company (Champion); Milwaukee Harvesting Company. Its officers are: President, Cyrus H. McCormick; chairman of Executive Committee, Charles Deering; chairman of Finance Committee, George W. Perkins; vice-presidents, Harold F. McCormick, James Deering, William H. Jones and John J. Glessner; secretary and treasurer, Richard F. Howe.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.

Punches & Dies. Wal.M.Wks., Waltham, Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Power press work wanted. 247 W. Broadway, New York.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

For Sale—2 H.-P. gas or gasoline engine; price $40. P. O. Box 1171, Springfield, Mass.

To license manufacturing the best friction pulley cut-off, etc. Address T. R. Bailey, Carpentersville, Ill.

Book, "Dies and Diemaking," 100 6x9 pages, $1, post paid; send for index. J. L. Lucas, Bridgeport, Conn.

For Sale—10 volumes AMERICAN MACHINIST, unbound; fair condition; low price. P. O. Box 240, West Derry, N. H.

Wanted—Good second-hand screw machine, 2 in. hole in spindle, or larger; oil pump, pan and back gear. "Machine," 247 W. Broadway, New York.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Light and medium machinery built to order; estimates furnished on all kinds of machine work. F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa.

Purchaser for an established manufacturing business, including patterns and tools; it is suitable for any first-class machine shop. Address No. 20, care AMERICAN MACHINIST.

Gear and milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears, catalog of small tools free. R. M. Clough, Tolland, Ct.

Mechanical designer, holding responsible position, graduate, inventive, experienced, wishes drawing work at home; specialty of designing new special and automatic machinery. J. H., care AMERICAN MACHINIST.

A party with $10,000 is desirous of taking an active interest in the manufacture of some light patented article for household or general business use. Save time by writing cost, selling price and full particulars to P. O. Box 505, Pittsburgh, Pa.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

Water power and home offered very cheap; Twenty-five (25) H.-P. "Success" wheel in iron penstock, about 2 acres land, a frame building, 24x40, 2 floors and basement (been used as storehouse); also good house, 18 rooms, built 1880, with lot 150 ft. square; $1,200 takes everything. J. Broadbent & Son, Unionville, Conn.

Owing to the death of one of the active members of a machine and foundry business (incorporated for $100,000) the present management wish to find a man with a thorough knowledge of the business, that would take hold with energy and invest some capital; this is a rare opportunity for the right man; paper and pulp mill machinery a specialty. Address M. & F., care AMER. MACHINIST.

For Sale—Half interest or entire plant, consisting of machine shop, foundry, pattern shop, large stock of patterns and boiler shop, in one of the largest Southern cites; well equipped for every class of work and now engaged on a large amount of profitable contract, repair and special work; location near center of city on main lines of several railroads; climate perfect. Address Box 755, AMERICAN MACHINIST.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Position by competent toolmaker and designer; A1 references. Box 767, AM. MACH.

Draftsman with practical machine shop experience desires position. Box 778, AM. M.

Experienced mechanical draftsman wishes to change. Box 791, AMERICAN MACHINIST.

Draftsman wishes position by middle of September; New York or vicinity. Box 773, A. M.

Position as designer, etc., by graduate, 28, mechanical draftsman. Box F, care AM. M.

First-class mechanical draftsman wants position; New York or Brooklyn. Box 762, AMERICAN MACHINIST.

First-class electrical draftsman, experienced in electric motor design, wishes position. Box 782, AMERICAN MACHINIST.

Mechanical draftsman, experienced in cranes and hoisting machines, wants position near New York. Box 792, AMER. MACH.

Mechanical draftsman, with 8 years' shop and drawing-room experience on locomotive work, desires change. Box 777, AM. MACH.

Foreman of large experience in agricultural and farming implements and up-to-date mechanic; good references. Box 781, AM. M.

Situation as superintendent or foreman of machine shop, by man of 24 years' varied experience, 12 in charge. Box 776, AM. MACH.

Party having charge of large manufacturing plant desires change; designing of automatic and hand screw machine tools a specialty. Box 771, AMERICAN MACHINIST.

Foreman toolmaker, capable of designing special machinery and fixtures and familiar with dies and tools for working sheet metal. Box 783, AMERICAN MACHINIST.

Patternmaker—Foreman of wide experience, both wood and metal, desires change; has been in charge with leading concerns; best references. Box 768, AMERICAN MACHINIST.

Draftsman (foreign) desires position; graduate; 2 years shop, 4 years drafting; centrifugal and triple pumps and general machinery; age 27. Box 788, AMER. MACH.

By foreman for foundry and machine works; can get good goods at low cost; 12 years' experience handling men; good mechanic; well educated. Box 765, AMERICAN MACHINIST.

Able to systematize screw machine work; 12 years' experience with a large electrical firm; expert and inventive; will handle from 10 to 100 machines. Box 780, AM. MACH.

Thoroughly competent foundry foreman open for engagement; past 6 years' experience with gas-engine concern; reliable at bidding on contracts or buying close. Box 770, AM. MACH.

Draftsman and designer, familiar with automatic and steam engine work; thoroughly practical and original; 12 years' experience; excellent reference. Box 793, AM. M.

Mechanic, 25 years' experience, watch, typewriters, typesetting, automatic machinery, precision screws, seeks position as foreman; 6 years with present employer. Box 789, AMERICAN MACHINIST.

Master mechanic or foreman of wide experience, technical education, designer of dies and special machinery, thoroughly up to date, wishes change; New York city or Brooklyn preferred. Box 772, AMERICAN MACHINIST.

Seventeen years thoroughly practical machine shop foreman (general) seeks position with good, up-to-date concern, where executive and methodical application would be appreciated. Box 790, AMERICAN MACHINIST.

Position as factory manager or superintendent, by practical mechanic with technical education and experience in handling help on medium weight work; available in September; best of references; age 33; married. Box 779, AMERICAN MACHINIST.

Practical superintendent; 25 years' experience on machine and tool work; superintendent of large, high-grade typewriter factory for 7 years; age 45; good organizer; understands cost-accounting, etc.; references. Box 784, AMERICAN MACHINIST.

Mechanical engineer and draftsman wishes to change in September; technical education; large experience as foreman, master mechanic and superintendent manufacturing small and medium interchangeable machinery and fine steel instruments. Box 712, A. M.

Help Wanted.

Wanted—Tool and jig maker. The Lane-Podley Co., John and Water sts., Cincinnati, Ohio.

Wanted—Competent draftsman to make working drawings for power hammers. Box 785, AMERICAN MACHINIST.

Mechanical and structural draftsmen; experienced technical graduates preferred. Box 71, Station B, Cleveland, Ohio.

Wanted—First-class rifle and shot-gun stocker; steady work for proper man. Remington Arms Company, Ilion, N. Y.

Wanted—A first-class wood pattern maker; ten hours day; wages 30c. per hour. Address Wm. E. Hill & Co., Kalamazoo, Mich.

Good salesman to sell gas engines; either salary or commission to the right man; give age, experience and terms. Box 766, AM. M.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—Toolmakers, at once; first-class men on jig and fixture work. Call on or address The Taft-Pierce Mfg. Co., Woonsocket, R. I.

Wanted—A first-class high-speed engine designer and draftsman; state wages expected and give references. Reeves Engine Co., Trenton, N. J.

Wanted—By the Morris County Machine & Iron Co., Dover, N. J., two first-class machinists, accustomed to accurate lathe and planer work.

Wanted—First-class draftsman on Corliss engine work; state experience and salary wanted. Weimer Machine Works Company, Lebanon, Pa.

Wanted—First-class lathe and machine hands at The Reeves Engine Company, Trenton, N. J. Steady work and good wages to first-class men.

Wanted—Ten good patternmakers at once; new shop and equipments; good wages. The Balkwill Pattern Works, 970 Hamilton st., Cleveland, Ohio.

Wanted—First-class mechanical draftsman, experienced on direct-current motors; state experience and salary expected. Box 763, AMERICAN MACHINIST.

Wanted—Thoroughly competent machine shop foreman; one familiar with engine and hoisting engine work preferred. Answer Box 769, AMERICAN MACHINIST.

Wanted—Automatic monitor machine hands; only experienced men need apply. Call between 8 A. M. and 2 P. M. at R. Hoe & Co., 2 Sheriff st., New York City.

Wanted—Several A1 draftsmen; give experience, reference and salary expected. Engineer in Charge, Drafting Department, General Electric Co., Schenectady, N. Y.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—Inspector with wide experience on light, interchangeable parts, similar to watches and typewriters. Address, with references, Box 747, AMERICAN MACHINIST.

Foreman diemaker; well experienced in manufacture of dies for tin cans and articles of sheet metal; progressive and energetic man. Address Box 786, AMER. MACHINIST.

Wanted—First-class mechanical draftsman; technical graduate and one familiar with hoisting machinery preferred; state experience and wages expected. Box 53, Providence, R. I.

Wanted—First-class machinists experienced on compressor or engine work; steady employment for good men. Chicago Pneumatic Tool Company, Franklin Air Compressor Works, Franklin, Pa.

Wanted—First-class toolmakers, experienced on punch and die work; must also be first-class men on general work; state experience, also wages expected. Richmond Electric Company, Richmond, Va.

Wanted—Foreman for drilling department, large manufacturing concern; one accustomed to handling help, and knowledge of latest practice. Address, with references, Box 746, AMERICAN MACHINIST.

Machinist, competent in all respects to take charge of small shop in Philadelphia; must be a hustler and up to date in modern methods; good salary. Address, with references and expectations, F. J. Stokes Machine Co., Philadelphia, Pa.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—Good, all-round machinist of executive ability to start on general work with view of taking charge of department; location Boston. Address, with references, stating age, experience and wages expected. Box 787, AMERICAN MACHINIST.

Wanted—Competent machine shop foreman for engine works in Indiana; to a capable, steady man who is energetic and knows how to handle both men and tools to the best advantage we can offer a good position; state experience fully, giving references and salary expected. Address Box 775, AMER. MACH.

Designing draftsman wanted; an experienced mechanical draftsman on general engineering, accustomed to producing complete specifications with designs; applicants will state previous experience, salary expected, age and references; good prospects for a suitable man. Address Box 748, AMER. MACH.

A thoroughly practical and energetic mechanic, about 35 to 40 years old, to take charge of several toolmakers; capable to design, invent and develop new ideas; must be well versed on small gears, screw machine and press work, somewhat in the nature of clock work, also other work not so fine; must be thoroughly posted in manufacturing to get out work at low cost; factory at Newark, N. J. Address, stating age, experience, wages expected, giving full particulars, Box 774, A. M.

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Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.

Arbor Press

Barnes Co., W. F. & John, Rockford, Ill.
Bartlett, E. E., Boston, Mass.

Balls, Steel

Federal Mfg. Co., Cleveland, O.
Grant Tool Works, Franklin, Pa.

Barrels, Steel

Cleveland Wire Spring Co., Cleveland, O.
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Ball Bearings

See Roller Bearings.

Bars, Boring

Cleveland Twist Drill Co., Cleveland, O.
Underwood & Co., H. B., Philadelphia, Pa.

Belt Dressing

Dixon Crucible Co., Jos., Jersey City, N. J.
Houghton & Co., E. F., Philadelphia, Pa.

Belt Lacing Machines

Diamond Drill & Mach. Co., Birdsboro, Pa.

Belting, Leather

Shultz Belting Co., St. Louis, Mo.

Bending Machines, Hydraulic

Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Bending Machines, Power

Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Reade Mchry. Co., Cleveland, O.

Blocks and Tackles

See Hoists, Hand.

Blowers

Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.

Boilers

Chandler & Taylor Co., Indianapolis, Ind.
Struthers, Wells & Co., Warren, Pa.

Books, Mechanical

Baird & Co., Henry Carey, Philadelphia, Pa.
Henley & Co., N. W., New York.

Bolt and Nut Machinery

Acme Mchry. Co., Cleveland, O.
Detrick & Harvey Mach. Co., Baltimore, Md.
Howard Iron Wks., Buffalo, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Wells Bros. Co., Greenfield, Mass.

Boring and Turning Mills

American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Boring and Drilling Machines, Horizontal
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provl., R. I.
Bement, Miles & Co., N. Y. City.
Betts Mach. Co., Wilmington, Del.
Binsse Mach. Co., Newark, N. J.
Dallett & Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fosdick Mach. Tool Co., Cincinnati, O.
Franklin Mach. Wks., Phila., Pa.
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Niles Tool Works Co., New York.
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Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

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Miami Brass Works, Hamilon, O.

Castings, Brass and Bronze
Christensen Engineering Co., Milwaukee, Wis.
Miami Brass Wks., Hamilton, O.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Steel
Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Newark, N. J.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Centering Machines
Bement, Miles & Co., New York.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Tool Works Co., New York.
Phoenix Mfg. Co., Hartford, Ct.
Pond Mach. Tool Co., New York.
Whiton Machine Co., D. E., New London, Cann.

Chains, Driving
Boston Gear Works, Boston, Mass.
Federal Mfg. Co., Cleveland, O.
Bridgeport Chain Co., Bridgeport, Conn.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Whitney Mfg. Co., Hartford, Ct.

Chucking Machines
Cleveland Mach. Screw Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Goodell-Pratt Co., Greenfield, Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankfort, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
The E. Horton & Son Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Coil Clutch Mfg. Co., New York.
Eastern Mach. Co., New Haven, Conn.
Faneuil Watch Tool Co., Boston, Mass.
Jacobson Mach. Mfg. Co., Warren, Pa.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

Compressors, Air
Blanchard Mach. Co., Boston, Mass.
Chicago Pneumatic Tool Co., Chicago, Ill.
Christensen Engineering Co., Milwaukee, Wis.
Gray-Blaisdell Co., Bradford, Pa.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Rand Drill Co., New York.

Consulting Engineer
Thompson, Hugh L., Waterbury, Conn.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.

Correspondence Schools
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Countershafts
Builders' Iron Fdry., Provl., R. I.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Reeves Pulley Co., Columbus, Ind.
Wheaton Mach. Co., Boston, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Counters, Machinery
Veeder Mfg. Co., Hartford, Conn.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.

Couplings, Shaft
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.
Vandergrift Coupling Co., Evansville, Ind.

Cranes
Brown Hoisting Mach. Co., N. Y. City.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutting off Tools
Armstrong Bros Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Cyclometers
Veeder Mfg. Co., Hartford, Conn.

Diamond Tools
Dickinson, Thos. L., New York.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
Wold & Co., Torris, Chicago, Ill.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

Drafting Machine
Universal Drafting Mach. Co., Cleveland, O.

Drawing Boards
Zacharias, E. M., Brooklyn, N. Y.

Drawing Instruments
Keuffel & Esser Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Sphingfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Gang Co., Wm. E., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Dwight Slate Mach. Co., Hartford, Conn.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dust Collectors
Allington & Curtis Mfg. Co., Saginaw, Mich.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrically-Driven Tools.
Clark, Jr., & Co., Jas., Louisville, Ky.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Howard Iron Wks., Buffalo, N. Y.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Stover Engine Wks., Freeport, Ill.
Struthers, Wells & Co., Warren, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Chandler & Taylor Co., Indianapolis, Ind.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Exhaust Heads
Burt Mfg. Co., Akron, Ohio.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

File and Tool Holder
Bowers, Geo. W., Waltham, Mass.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.

Filing Machines
Cochrane-Bly Mach. Co., Rochester, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Filters, Oil
Burt Mfg. Co., Akron, O.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Westmoreland Steel Co., Pittsburgh, Pa.
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dwight Slate Mach. Co., Hartford, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wk., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Chicago, Ill.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Turley, J. G., St. Louis, Mo.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Browning Mfg. Co., Milwaukee, Wis.
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.
Russell, R. M., Binghamton, N. Y.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Russell, R. M., Binghamton, N. Y.
Safety Emery Wheel Co., Springfield, Ohio.
Tanite Co., Stroudsburg, Pa.
Vitrified Wheel Co., Westfield, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Tanite Co., Stroudsburg, Pa.
Vitrified Wheel Co., Westfield, Mass.

Grindstones
Cleveland Stone Co., Cleveland, O.
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Hoefer Mfg. Co., Freeport, Ill.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Merrill Bros., Brooklyn, N. Y.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Eastern Mach. Co., New Haven, Conn.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sprague Electric Co., New York.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Insurance, Boiler
Hartford Stm. Boiler Insp. & Ins. Co., Hartford, Conn.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathe Feed
National Mach. & Tool Co., Cincinnati, O.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fay & Scott, Dexter, Me.

Lathes—*Continued*
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.
Tanite Co., Stroudsburg, Pa.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Wyke & Co., J., E. Boston, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Prov., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Molds, Hammer and Vise Jaw
Field, Chas. H., Providence, R. I.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
Browning Mfg. Co., Milwaukee, Wis.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Wks., Belleville, N. J.

Motors, Electric—*Continued*
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.
Murdock Parlor Grate Co., Boston, Mass.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Lathe
New Britain Mach. Co., New Britain, Conn.

Pans, Shop
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Frothingham, N. L., New York.
Stevens & Co., Milo B., Washington, D. C.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Field, Chas. H., Providence, R. I.
Greaves, Klusman & Co., Cin., O.
Machinery Exchange, Chicago, Ill.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Gobeille Pattern Co., Cleveland, O.
Lorentz & Evarts, Hartford, Conn.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers, Portable
Morton Mfg. Co., Muskegon Heights, Mich.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Planers
American Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.

Planers—*Continued*
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Presses, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.
Wold & Co., Torris, Chicago, Ill.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Howard Iron Wks., Buffalo, N. Y.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Racks, Tool
New Britain Machine Co., New Britain, Conn.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Reamers
Chadwick & Co., G. B., Portsmouth, N. H.
Cleveland Twist Drill Co., Cleveland, O.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting.
Cooke Machinery Co., New York.
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
Amer. Roller Bearing Co., Boston, Mass.
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Nutter, Barnes & Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
State College of Kentucky, Lexington, Ky.
Pratt Institute, Brooklyn, N. Y.
Purdue University, Lafayette, Ind.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.
York Mchry. Co., S. M., Cleveland, O.

Separators, Oil
Amer. Tool & Mach. Co., Boston, Mass.
Springfield Separator Co., Springfield, Vt.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Shop Shelving
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Sprocket Chains
See Driving Chains.

Stampings, Sheet Steel
Federal Mfg. Co., Cleveland, O.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Steel, Machinery
Hermann Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Federal Mfg. Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriarche & Bell, New York.
Westmoreland Steel Co., Pittsburgh, Pa.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Straightener, Screw
Towsley Mfg. Co., J. T., Cin., O.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Trucks, Shop
Towsley Mfg. Co., J. T., Cin., O.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
Amer. Tool & Mach. Co., Boston, Mass.
Automatic Mach. Co., Greenfield, Mass.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Foster, Walter H., New York.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.
Gray & Prior Mach. Co., Hartford, Conn.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Howard Iron Wks., Buffalo, N. Y.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

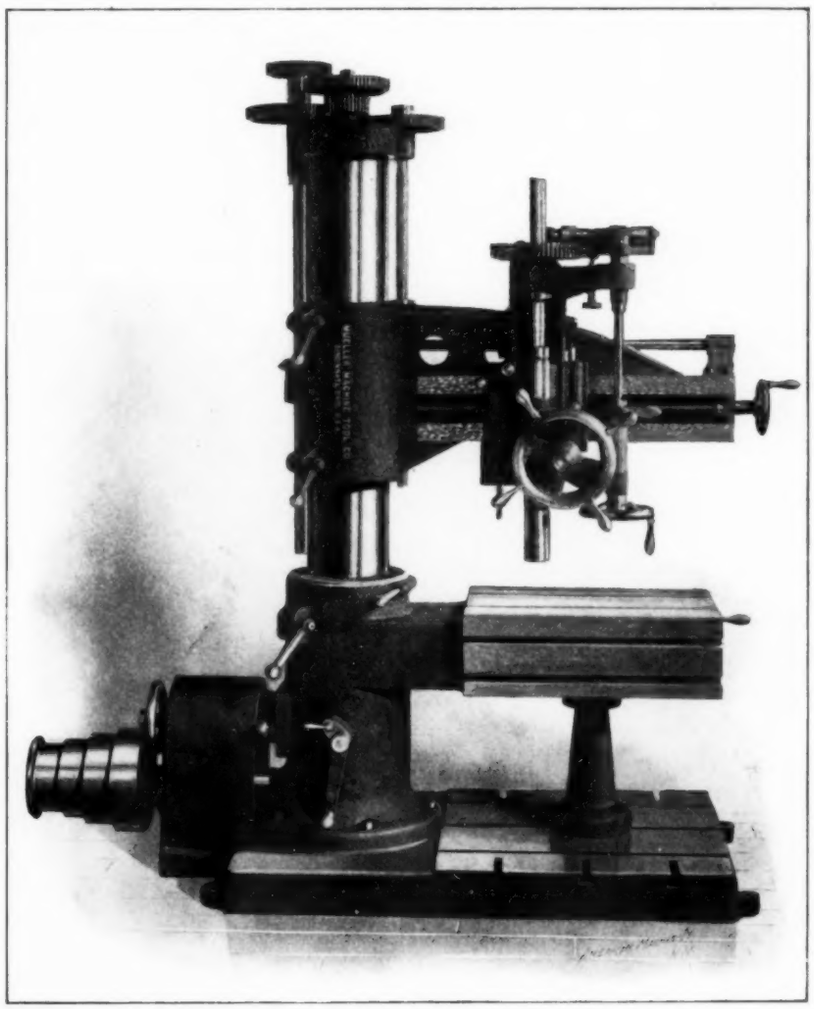
Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

A New Radial Drill.

The Mueller Machine Tool Company, of Cincinnati, O., has recently brought out a new 30-inch radial drill, and in the accompanying half-tone the machine is very clearly shown.

The round column upon which the arm is mounted is bolted securely to a heavy, well-ribbed base and provided at the top with a cap resting on hardened steel balls, this cap supporting the arm and revolving easily with it about the column. A four-step driving cone is provided, and by shifting the crank shown at the base of the column twelve speeds for the spindle are obtained without stopping the countershaft. The handle for starting, stopping and reversing the spindle, and for elevating and dropping the arm at an increased speed, is carried in a loose ring placed around the column above the swinging platen. This ring when turned operates a lever which is placed inside of the column and connected by a rod to the friction clutches in the gear box at the back of the machine. The ring is adjustable, and the starting lever can be conveniently reached from any part of the machine. When the spindle is not in use, the lower driving shaft is the only one in motion, this feature prolonging the life of the machine.

The feed can be raised from 0.007 to 0.021 inch per turn of spindle, by shifting the small friction wheel—shown above the head—across the face of the raw hide covered driving gear. This small friction wheel drives a worm and wheel, and the latter a vertical shaft which is connected to the regular hand-feed worm and wheel. The pressure suitable for a given feed is obtained by turning the knob shown to the left of the vertical feed shaft. This knob is also turned when it is desired to stop the feed shaft or to change the feed. The head is provided with a depth gage reading from zero, this device enabling the operator to set the automatic stop to release the spindle feed at any desired point. A safety stop prevents the spindle from feeding beyond a certain point. The usual quick return for the spindle, and tapping device are provided for. Each clamping screw is tapered at the end and its handle is forced up in place by a nut. When wear occurs between the clamping handle and the surface against which it bears, the nut can be loosened and the handle reset on the screw to clamp at any point, it being fitted on a taper. The net weight of this drill is 3,000 pounds.



NEW RADIAL DRILL.

The Use of Both Hands.

Arguing from the fact that there is no sound reason why the left hand should not be developed equally with the right hand, and from the further fact that many physicians who have given the matter some study see in the use of both hands to the same extent very satisfactory results on the general health, school authorities in Germany have made left-hand work during part of the time compulsory on the student.

Much of the mechanical work that is now done with the right hand could be done as well with the left hand, if that member were sufficiently trained, and the division of labor thus made possible would not only result in more efficient work, but in an increased quantity of it. It is, of course, very evident that when both hands are equally dextrous, they may be used alternately and the worker need never stop for rest, for as soon as one hand gets tired he can use the other.

Accordingly, the German authorities have given considerable attention to left-hand work in their mechanical schools. The students are taught to saw, plane and hammer as well with the left hand as with the right, and the importance of ambi-dexterity is impressed upon the minds of the young men and women.

Among artists the use of both hands is not by any means an uncommon accomplishment. They, more than any others, realize the real importance of it. Menzel and Klimsch, both renowned painters, may be mentioned as instances of men who in the performance of their work employed both hands equally.

In Japan the children are taught to write and draw with both hands at an early age. It is to that method, indeed, that many attribute the superiority in certain classes of Japanese art. The entire arm is employed in drawing, and no supporting device whatever is used. In a similar manner the German scholars are made to draw large circles and other figures on the blackboard, first with one hand, then with the other, and without any brace on which to rest wrist or elbow, the whole arm thus being brought into action.

Just why one employs the right arm in so many things in preference to the left is a question which has not as yet received a conclusive answer. The more commonly accepted idea is that the habit is directly due to the fact that a mother invariably carries a child on her left arm, so that she, the carrier, may have the free use of her right arm.

Then, again, there are those who say that the physiological construction of the nerves and veins that enter the right arm is different to that of those which enter the left one, the nerves and veins of the right arm being more prominent. But, de-

spite the fact that an examination of the left arm of a left-handed person reveals the fact that his left arm contains more prominent veins and nerves than his right, it is, nevertheless, impossible to say whether the phenomenon noticed is the effect of the habit or the habit the effect of the phenomenon.

The art of writing equally well with both hands is one that should be cultivated and acquired by everyone. Even a slight accident to the right hand incapacitates one nowadays from all manner of work, whereas, if the use of the left hand were cultivated as it should be, such misfortunes would lose much of their inconvenience.

Slight practice will work wonders. Write the alphabet through five times a day for a month, and at the end of that time you will be surprised to find that you can write as well with your left hand as with your right; and yet that is a fact.

To sew with the left hand is, of course, a somewhat more difficult task; but that, too, can be overcome with constant practice. In fact, there is not a thing which we now do with our right hands alone that we could not do with equal facility with our left hands if we only practiced a little.—*English Mechanic and World of Science.*

An Opinion About the Metric System Based on Experience With It.

Our readers know that our efforts in connection with the discussion of the metric system and its introduction in this country have been in the direction of obtaining facts regarding it and also of obtaining the opinions of men who are in a position to have well-founded views about it, and especially those mechanicians or engineers who have had opportunities of using both systems and can therefore speak from experience with both and draw intelligent comparisons. With this in view we have asked a number of engineers and mechanics, who have, within the past few years, gone abroad, where they have been called upon to work by the metric system, for their views. Among these we have asked for an expression of opinion from Mr. C. L. Libby, who, before going to Germany some years ago, was a well-known machine tool designer here, and was of course thoroughly accustomed to measuring, estimating and computing by the inch and pound system. His experience of some years at the Ludwig Loewe place in Berlin gave him an opportunity of becoming familiar with the metric system, because it is used exclusively there, and in reply to our letter of inquiry Mr. Libby writes as follows:

"As to the relative merits of the metric and English systems of measurement, after having used the metric system for four years in Germany, I must say that I think it far superior for both machine shop and drawing room.

"The inch is such a large unit that it must be subdivided in fractional parts, and when the dimensions of a piece are given on a drawing in eighths, sixteenths, thirty-seconds and sixty-fourths, as is often the case, it becomes difficult for the average mechanic to add them together correctly. On the other hand, the millimeter is so small a unit that it is seldom necessary to subdivide it into fractional parts. If it becomes necessary to subdivide the millimeter it is always given in decimals, and one can multiply, divide or find the log. without first reducing to its equivalent decimal, as one does with the fractional parts of an inch.

"I think a drawing figured in millimeters is more convenient and looks much better than when the inch and fractions are used, and I am of the opinion that there is less liability to error on the part of the draftsman.

"Of course it takes some time to be able to think in millimeters and get a clear idea of just how much a given measure in millimeters is, without first translating to inches. But after a little, and almost unconsciously, one begins to think in millimeters without referring to the inch."

Electrically-Driven Cold Saw Cutting-Off Machine.

We recently illustrated three belt-driven cold saw cutting-off machines, built by Gustav Wagner, Reutlingen, Würtemberg. The accompanying illustrations show two of his electrically driven machines, the arrangement of the saw, the swivel head and the feed, being practically the same as in the belt-driven machines.

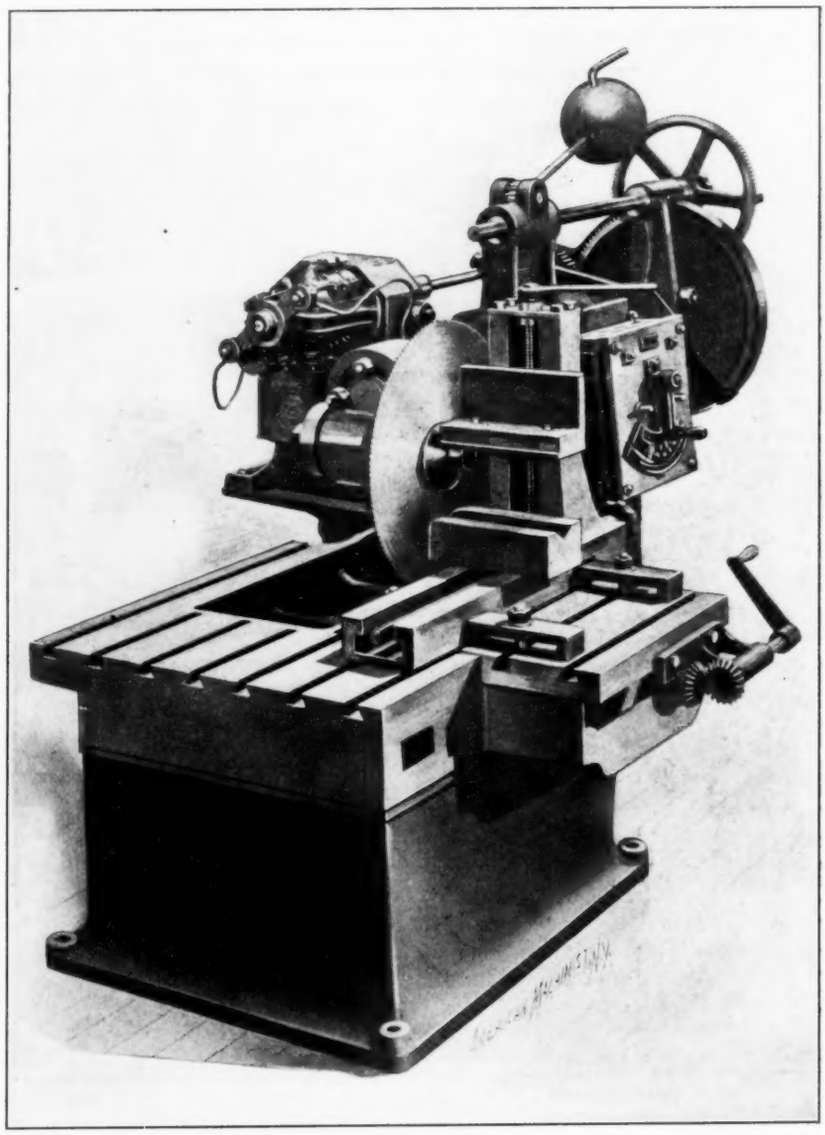


FIG. 1. ELECTRICALLY-DRIVEN COLD SAW CUTTING-OFF MACHINE.

The machine shown in Fig. 1 handles stock up to 15x6 inches, the saw being 20 inches in diameter. The vise is carried on a cross slide and several cuts can be made without shifting the work in the jaws. As the jaws are arranged to move at right angles to each other—each jaw having its own screw—a great variety of work can be held. The motor is mounted at the left, as shown. A pan is formed at the

top of the table, for holding lubricant for the saw.

The machine shown in Figs. 2 and 3 carries a saw 40 inches in diameter and is designed for work on heavy castings or forgings which are not readily moved about. The motor is attached to the back of the vertical slide. This slide is counterbalanced and has a travel of 40 inches. desired the machine is furnished with a fixed bed, or with a revolving bed plate in front, upon which the work can be placed.

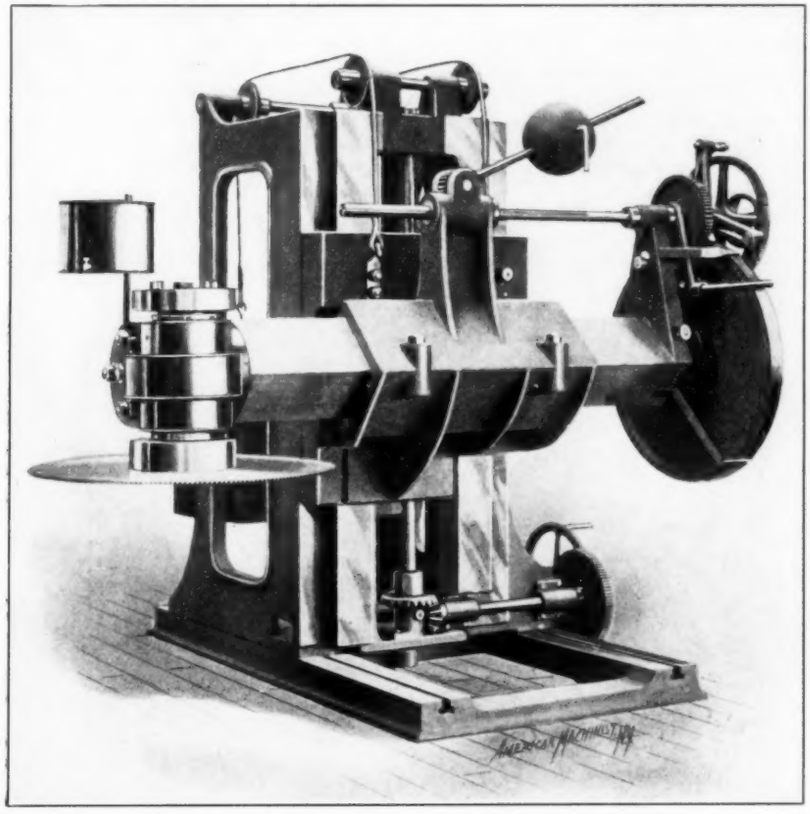


FIG. 2. ELECTRICALLY-DRIVEN MACHINE FOR HEAVY WORK.

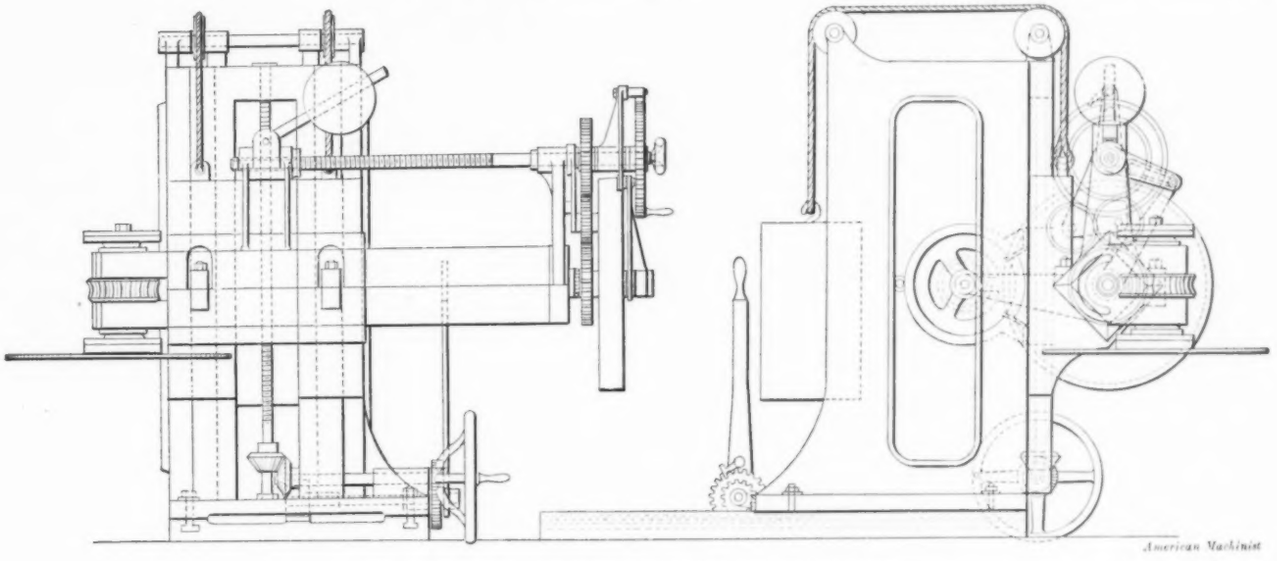


FIG. 3. ELECTRICALLY-DRIVEN MACHINE FOR HEAVY WORK.

The machine, as shown, is mounted on an extra bed, along which it can be moved by means of a lever which operates a pinion meshing with a stationary rack. When

Echoes from the Oil Country.

WHERE DID IT GO TO?

Often a thing takes on an entirely different appearance if examined from a different point of view, and a jog that dislodges us from our usual spot may do us good. Just as likely as not this jog may be given by someone not posted in our line of work, but still the ideas awakened may start us thinking.

A firm situated in the heart of Pittsburgh was crowed for room and had done quite a little experimenting in efforts to improve on their power plant. For years they had used steam, and the engine and boiler were located underneath the shop, which was a combination of machine shop, blacksmith shop and wood-working shop. As things became more crowded, the cellar got to be a place difficult to get to. It was hard to get coal down and just as hard or harder to get ashes out. Besides that it was a dark, poorly ventilated place to ask a man to stay in, and it was hard work to climb up a little winding stairway between firings to get fresh air.

As a means to save room, expense and trouble, an electric motor was tried. This did not prove altogether what was desired, and finally a gas engine was put in, and this, after they had become a little acquainted with it, seemed to fill the long-felt want in fine shape.

As the gas engine was not then nearly so common as it has since become, one of the owners used to be at some pains to explain its workings and virtues to visitors. On one occasion he had been entertaining a missionary society that was connected with the church he attended. After dinner the party was taken through the shops. Coming to the gas engine, their host explained its workings at some length, winding up with the statement: "Using it instead of steam saves us $1,300 a year."

"And what do you do with it?" asked a bright young lady of the party.

"We run the shop with it. It furnishes the power for everything upstairs. The wind in the blacksmith shop is made by it. Everything you saw turning around in the works is turned by it. You see we save room. We save in attendance, and we save in fuel. We save in getting the fuel in and the dirt out. It is a great thing

for us in our business. You can see that, for it saves us $1,300 a year." And he bowed cheerfully to his fair questioner.

"Now, that is very nice," she replied. "I am glad to hear it. And what do you do with it?"

The gentleman, thinking he had not made his meaning clear to one not likely to be at all familiar with shops and shop ways, very patiently went over the ground again, telling how it was necessary to have some means of getting motion, telling of their use of the various methods, giving the advantages and disadvantages of each, and, after having done his best, he wound up with the strong point of the saving caused by his last method.

"That is very interesting, very interesting indeed; and what do you do with it?" asked the young lady once more.

With a strong effort to think of a way to put the matter in a simpler form he began again: "You know it is necessary for us to have something to run our shop to make the wheels go round—" "Yes, yes, I see all that; but what do you do with the $1,300 you save every year?" And the young lady looked around in an inquiring way as though expecting to see it stowed away somewhere. (You must remember that she belonged to a missionary society.)

I am not just sure how he explained that part to her, but when he told it to me we had a good laugh together.

"It seemed very real, that $1,300, the way she spoke of it," said he, "but, really, while I can figure that we have had that much less to pay for fuel, wages and so forth, still it seems just as hard to be ready for payday and to find money to pay the bills as ever it did. Perhaps you have had experience enough to be able to tell me how to get my hands on it."

My experience had not been varied enough to be of much use. While I believed that my efforts in the way of shop economies may have helped to keep a certain important county official from forming too close a connection with the business, I had never had to lie awake nights thinking how to best take care of the money that they saved. I told him I would willingly pay the freight on any surplus he might be troubled in finding room for, and I am willing to hold that offer open against all comers. If anyone with experience in changing such things from figures to facts with reasonable certainty will kindly send me the rule, I will do my best to commit it to memory, and will gladly send a "vote of thanks" in return.

W. OSBORNE.

A Water Dynamometer.

The following description of a highly interesting absorption dynamometer is taken from *The Engineer*, of London. We have, however, obtained some additional information from the makers and have made such slight changes in the article as were necessary to incorporate it:

This machine, which is shown in the accompanying illustrations, was originally designed by the late Mr. William Froude for use in his experiments on the propulsion of ships, but has since been largely modified for use with stationary engines, and is claimed to be the machine best adapted and most trustworthy for superseding the old type brake band for testing the brake horse-power of steam engines and motors. An earlier form of hydraulic brake took the shape of an ordinary centrifugal pump, the resistance to rotation being varied to some extent by a valve placed in the outlet pipe. But to measure large powers, say 500 to 1,000 horse-power, the apparatus would have become very cumbrous, and the range through which the power absorbed could be regulated would be insufficient. To meet these difficulties Mr. William Froude invented a new form of rotator and case, which gave a vastly increased resistance for given over-all dimensions, and also provided means for regulating the resistance through a very considerable range.

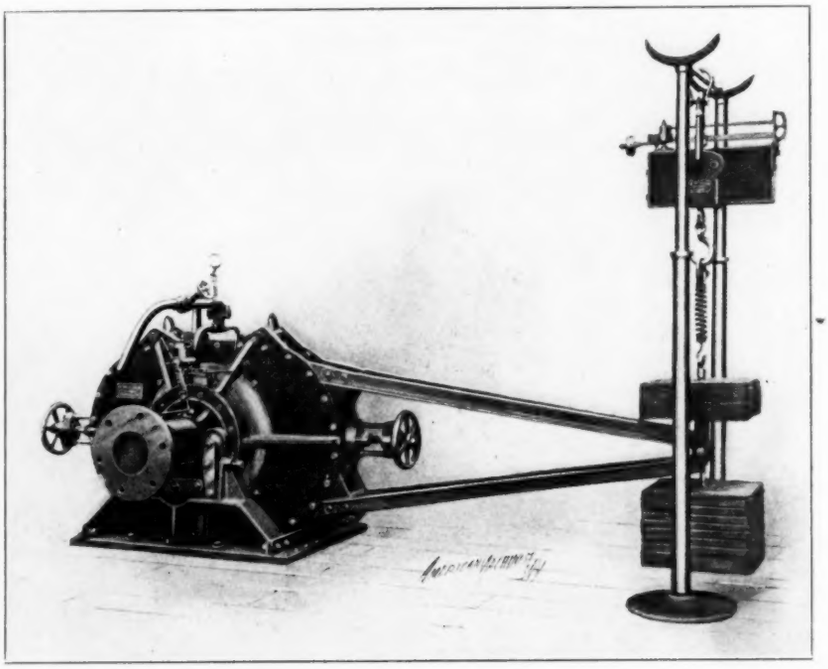


FIG. 1. THE FROUDE WATER DYNAMOMETER.

The general arrangement of the machine is shown in Fig. 1. It consists of a case or shell within which revolves the wheel or rotator. The latter is a circular disk, and on each side is formed a circular channel of semi-elliptical cross-section. These channels are placed back to back, and are provided with a number of vanes fixed obliquely, as shown in cross-section in Fig. 2. On each side of the casing similar channels are fixed, and also provided with vanes, thus forming two complete circular channels of elliptical cross-section—see Fig. 3—the channels being divided into a number of complete compartments by means of oblique vanes. The apparatus being completely filled with water, and the rotator set in motion, the water contained in the cups of the rotator, under the action of centrifugal force, is delivered from their outer surface, and thrown with considerable force against the upper part of the fixed cups in the casing. The water then circulates around the outer surface of the fixed cups and enters the bottom edge of the moving cups with an increased velocity due partly to the velocity of its delivery from the fixed cups and partly to the velocity with which the cups of the rotator meet the jet as it is delivered from the fixed cups. Thus a whirlpool or vortex motion is set up in each cup, the power required to drive the rotator being mainly expended in keeping this going. The whole of the power exerted being converted by friction into heat in order to keep the machine cool, it is necessary to introduce a continuous supply of cold water. In doing this it is essential that the whirling motion should not be disturbed, so the water is conducted through holes up the

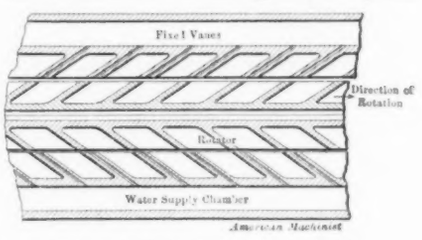


FIG. 2. CROSS-SECTION OF VANES.

fixed vanes to points lying in the center of the vortex where the pressure and velocity are low, and the circulation water being under a pressure of 15 to 20 pounds per square inch, lodgment of air at this place is prevented. The inlet pipe for cold water

is connected to a circular supply channel at the back of each set of fixed vanes, while the hot water is continually escaping into the outer part of the case and leaves by the outlet pipe shown, which, being at the highest point of the case, assists the escape of air or steam. The connections of these pipes are flexible, so as not to affect the balance of the machine. Cocks are also provided to permit any air collected to escape. It is interesting to note that the total power absorbed may be considerably increased by making the interior surfaces of the cups as smooth as possible, so as to admit of very high velocities of circulation in the individual cups. The power absorbed by the dynamometer is reduced when required by interposing thin metallic shields between the faces of the rotator and casing, thus cutting off what may be termed the vortex action. These shields are operated by the hand wheels shown in Fig. 1 at each end of the machine. In this manner the power may be reduced from the maximum down to about one-fourteenth of that amount. It will be noticed that the weight of the casing is not supported by the shaft, but is carried by means of friction rollers. The rollers are provided with a slight adjustment, so that the shaft may be readily brought into line with that of the engine or motor shaft required to be tested. The revolving rotator necessarily reacts on the case, tending to carry it around with it, the turning moment being equal to that exerted on the driving shaft. The case, being carried on the rollers mentioned, is prevented from turning by a weighted lever, as shown in Fig. 1. It is found convenient in order to secure steady readings to provide a greater weight than is actually required, the portion not supported by the brake being carried by a Dension balance, as shown. The effective weight is, of course, the total weight minus the reading of the balance. For instance, suppose the effective weight supported is W pounds at 5 feet 3 inches radius and the revolutions are N per minute. Now, 5 feet 3 inches radius corresponds to a circle of 33 feet circumference, hence the formulas for the

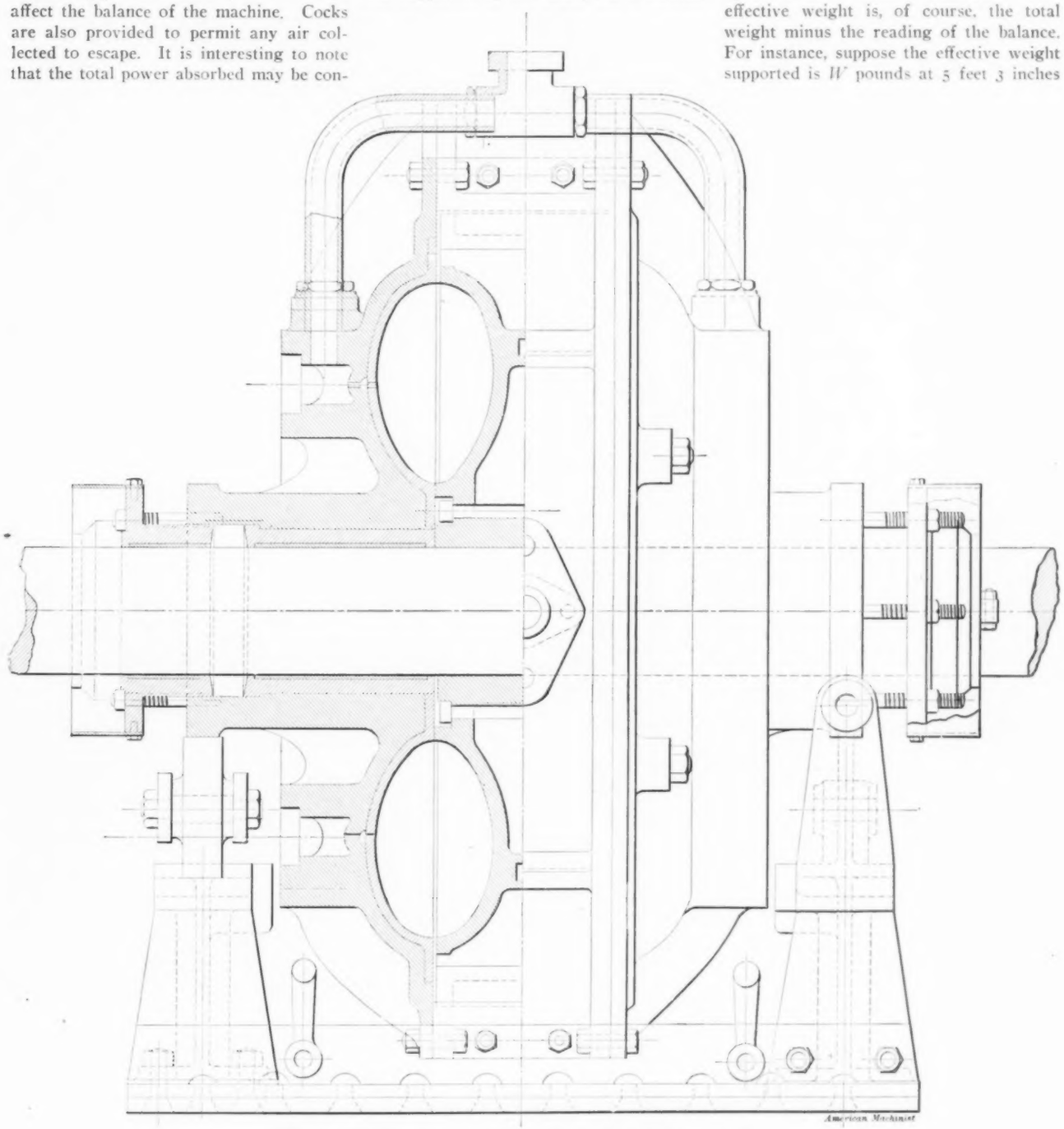


FIG. 3. SECTION AND ELEVATION PARALLEL WITH DRIVING SHAFT.

$$\text{Brake horse-power} = \frac{W \times 33 \times N}{33{,}000} = \frac{W \times N}{1000}$$

In using the machine the rotator shaft is first brought into line with the engine

or motor to be tested and is coupled up. Water is admitted by the inlet pipe, the outlet being opened for the escape of air. As soon as running is commenced, the water inlet should be opened full, the flow of water being regulated by the outlet, so that the outflowing does not attain too high a temperature, and a certain amount of pressure is thus maintained in the casing.

The machine is made in seven standard sizes, and the differences between the various powers are obtained by the regulation of the shields mentioned above. The maximum power which the machine will absorb varies as the square of the speed; thus, if a given dynamometer takes 100 horse-power to drive it at 100 revolutions, it will take 400 horse-power to drive it at 200 revolutions. The capacity of the machine is remarkable, the size having a rotator of 30½ inches diameter being able to absorb 1,100 horse-power at 350 revolutions per minute. The smallest, or 15½-inch size, has a capacity of 50 horse-power at 350 revolutions per minute.

The water is prevented from passing out between the casing and the main shaft by the use of ordinary glands and packing, but it will easily be seen that no error is made by their friction, as this reacts on the case in the same direction as the water. It may be interesting to note further that the range of temperature from inlet to outlet and the quantity of water used afford an accurate measure of the power, and the most recent determination of Joule's mechanical equivalent of heat was made by means of a Froude water dynamometer by Professor O. Reynolds and Mr. Morley.

The advantages claimed for this dynamometer for high-speed engines and motor testing may be summed up as follows: That (1) it is suitable for use at highest speeds and for very large powers; (2) it is capable of regulation to any power within its limits without adjustment of weights; (3) it is simple to work, and cannot easily get out of order; (4) it is portable, and requires practically no foundation; (5) it is absolutely correct in its results.

This machine is, we are told, fast being recognized as the standard for brake horse-power tests, and has been supplied to most of the leading engine and electric motor builders in this country. The makers are Heenan & Froude, of Aston Iron Works, Birmingham, who exhibit it at Wolverhampton, England.

Passengers crossing the Brooklyn Bridge may see an example of what appears to be an entirely new use for exhaust steam. An exhaust head on the top of an exhaust pipe has been enclosed by an enormous stew kettle and on the outside of this kettle is painted the advertisement of a well-known prepared soup. The exhaust head is not visible, but the steam that comes from it is, and the impression of a kettle of hot soup is quite realistic.

The Strength of an Egg Shell.

BY ALBERT E. GUY.

To treat of the egg is to write the history of the world. Only the genius of a Darwin can justly dilate upon the common origin of animal life; only the wit and philosophy of an Aesopus can extol the good and the evil of the egg.

As an experimenter, I must confess to having erred in my work; for, instead of beginning with experiments on beams,

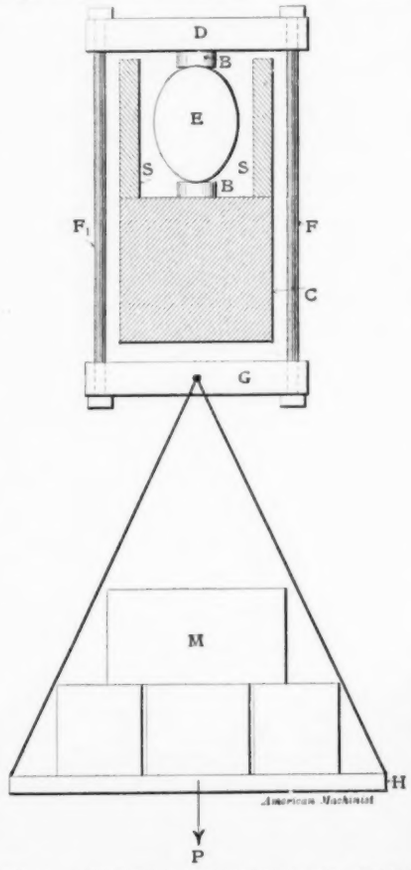


FIG. 1. APPARATUS FOR TESTING EGG SHELLS UNDER LONGITUDINAL PRESSURE.

logically, I should have begun *ab ovo;* but now, having redeemed myself by conducting scientific investigations on the strength of an egg shell, I feel so perfectly astounded at the results of the tests that I do not hesitate to proclaim that the egg should be placed at the head of the seven wonders of the world.

How insignificant seem the twelve feats of Hercules when we state that an egg shell can stand an internal pressure of 65 pounds per square inch and an external pressure of 675 pounds per square inch!

Although, as a direct consequence of the investigation conducted—science, alas! has its martyrdom—the writer has been constrained for two long weeks to endure, on the dining table, the presence in variegated attires and to absorb, for obvious reasons, the contents of the shells tested, he nevertheless feels much honored at being able to make known, for the first time, the measure of the resistance of the frail envelope of a hen's egg.

The history of the case is very simple: the writer—like many other readers, undoubtedly—had been requested by a "friend" to try his strength and break an egg by holding the latter on ends between the palms of his hands and pressing lengthwise with great force. The net result was a painful and tired feeling. The egg was next placed on a platform scale installed on the table of a drill press, and it gave way by crushing under an endwise thrust of about 60 pounds. Interest was then thoroughly aroused and a complete course of experiments mapped out and executed as detailed in the following.

Due process of eviction was served on the tenants of the shells before proceeding with the tests.

EXPERIMENTS—FIRST SERIES.

In this first series twelve egg shells were tested with the apparatus illustrated by Fig. 1, where *C* is the section of a beam firmly held in place, *E* the egg shell resting upon a piece of rubber *B* and supporting a frame *D F F*$_1$ *G*, to which a platform H is suspended.

A rubber distance piece *B* separates the crossbar *D* from the shell, so that this latter does not come into contact with hard surfaces. The shell was held in place until the platform, being lightly loaded and the center of the system very low, equilibrium was obtained. More weight was then applied, and finally a box *M* was placed on the platform and gradually filled with lead shot until the shell gave

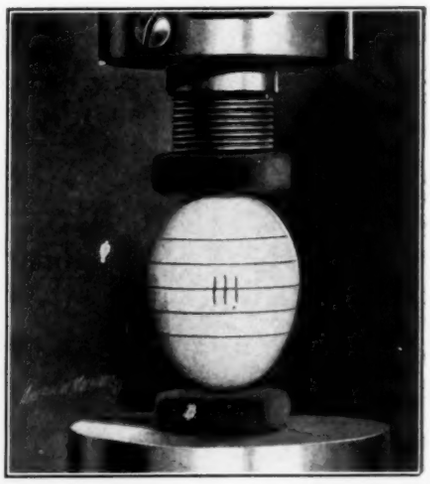


FIG. 2. EGG SHELL ARRANGED FOR TESTING IN A DRILL PRESS.

way. The crossbar fell and rested upon the supports *S S*, and thus, by not crushing entirely the shell, permitted the examination of the break.

Some shells gave way at the greatest circumference by breaking into small pieces averaging 5-16 x 5-16 inch, others by breaking into small fragments all over the surface, but none by shearing at the point of application of the load. This would show that the shells are of uniform resistance to lengthwise shearing. The diameter of the rubber pieces *B B* was

about 5/8 inch. One hole, 1-16 inch in diameter, was drilled at each end of the egg for the purpose of eviction, but that this boring did not affect the strength was proven by testing several full eggs under the same conditions, the results being equivalent to those obtained with empty shells.

Fig. 2 shows one shell tested on a drill press, before the load was applied. The rubber distance pieces used were ordinary pencil erasers. The test was made to see if the shell changed form under pressure. Another negative was taken of the same shell under a load of 50 pounds, and when the two negatives were superposed, the outline of the shell was the same in both plates. The lines seen on the shell were used to gage the vertical compression, but this was absolutely inappreciable on the plates.

The eggs used were not selected; on the contrary, they were taken at random. The crushing pressure varied from 40 to 75 pounds, the average being very nearly 55 pounds. The dimensions of the eggs for this first series are about the same as those of the other series, the average thickness of the shell being 13-1000 inch. These results are not at all astonishing, for a strong man can apply a much greater pressure on an egg—lengthwise—and yet not break it. To explain this we must remember that the distance pieces used in the tests were only 5/8 inch in diameter, and certainly did not bear all over their surface adjacent to the egg; whereas pressure applied between the palms of a man's hands will be distributed over a greater area than with the distance pieces, and thus the shell is able to resist better.

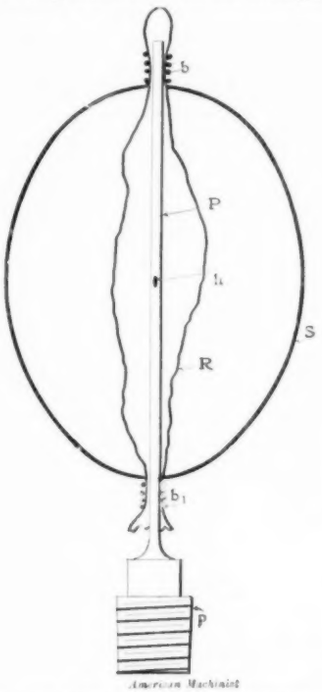


FIG. 3. EGG SHELL ARRANGED FOR TESTING BY BURSTING PRESSURE.

p = bursting pressure in pounds per square inch.
f = greatest tension or compression in pounds per square inch developed in the material composing the shell at the diameter D.
Color of shell: B = brown, W = white.
D = transverse diameter of the shell.
L = greatest diameter or length of the shell.
t = thickness of the shell, exclusive of the inner membrane.

No.	Color	D	L	t	p	f
		in.	in.	in.		
1	W	1.61	2.08	0.014	65	1868
2	W	1.69	2.25	0.014	39	1177
3	W	1.69	2.25	0.0135	46	1440
4	W	1.59	2.19	0.0135	51	1502
5	W	1.69	2.31	0.015	60	1690
6	B	1.61	2.14	0.0125	32	1030
7	B	1.65	2.16	0.0145	34	967
*8	B	1.6	2.21	0.0125	12	384
9	B	1.65	2.21	0.014	56	1660
10	B	1.62	2.2	0.0115	45	1585
11	W	1.6	2.13	0.0125	60	1920
12	W	1.62	2.36	0.0145	43	1201

*It was found upon applying the pressure that shell No. 8 was cracked at one end, and it consequently broke at once.

TABLE 1. TESTS OF EGG SHELLS UNDER INTERNAL PRESSURE.

No.	Color	D	L	t	p	f
		in.	in.	in.		
13	B	1.61	2.14	0.0145	675	18737
14	B	1.6	2.11	0.0145	*	
15	B	1.57	2.06	0.014	*	
16	W	1.5	2.13	0.0125	400	12000
17	W	1.53	2.11	0.0135	625	17708
18	W	1.62	2.16	0.0145	550	15362
19	W	1.66	2.18	0.0125	475	15770
20	W	1.58	2.17	0.012	425	13989
21	W	1.6	2.32	0.01175	675	22978
22	W	1.59	2.36	0.0135	540	15900

*Shells Nos. 14 and 15 were submitted to a pressure much greater than 400 pounds per square inch, but as the gage only indicated to 320 pounds it was disconnected, and thus the pressure was not recorded.

TABLE 2. TESTS OF EGG SHELLS UNDER EXTERNAL PRESSURE.

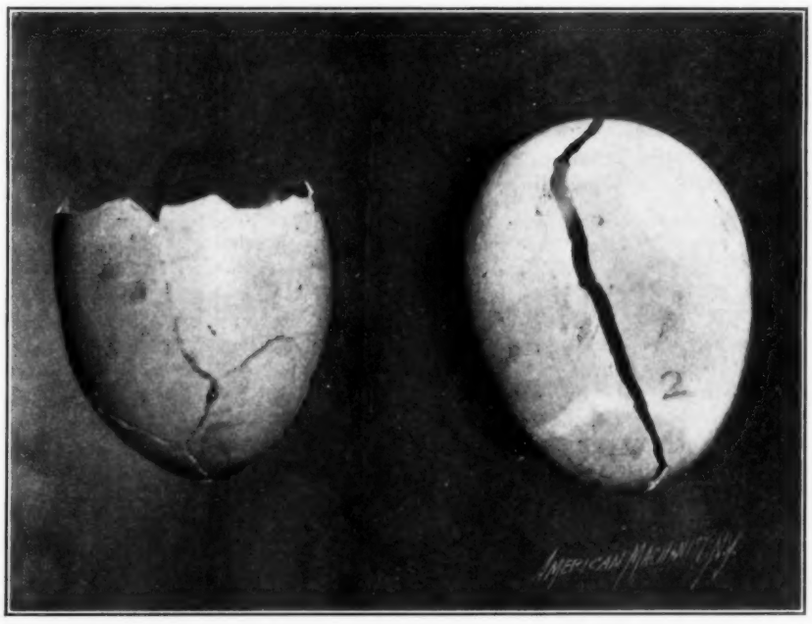


FIG. 4. FIG. 5.
MANNER OF FAILURE OF EGG SHELLS BY INTERNAL PRESSURE.

EXPERIMENTS—SECOND SERIES.

Thus far the tests were mere play, but when the time came to submit an egg shell to internal pressure I must confess there was quite a pause. The material of the shell is very porous, in the first place, and then a small pipe had to be introduced inside to convey the fluid pressure and a tight joint made at the opening. It was deemed out of the question to make this joint with cement, glue, shellac, or any other substance which might weaken or strengthen the shell. After much tinkering a very simple scheme was imagined, tried and found successful. Fig. 3 shows a shell all prepared for the test. S is the shell; R is a toy balloon made of very thin rubber; P is a piece of brass bushing wire, 1-16 inch outside diameter and 1-32 inch scant inside diameter; it is plugged at the upper end and soldered to a hollow 1/8-inch pipe plug p at the lower end. The balloon is tied to the wire at the top and bottom by means of a strong cotton thread $b\ b_1$, in such a way that the shell may be slightly but freely moved up and down on the wire. A small hole h cut into the hollow wire admits the fluid under pressure inside the balloon; which, when inflated, presses uniformly against the internal sur-

face of the shell and obviates the difficulty arising from the porous nature of the shell. The holes cut into the shell are just large enough to permit the wire and balloon, to be gently introduced without breaking the edges of the holes. It was necessary to have the two holes axially opposite in order to preserve the balance of the internal pressure. It is worthy of notice that great care must be exercised in cutting the holes; a milling tool 6-100 inch in diameter was used at first and then another 13-100 inch in diameter for finishing. If the operation is not carefully done very fine fissures are apt to be formed, and as soon as pressure is applied the shell breaks at once at the ends; it is therefore greatly decreased in strength.

The plug p being screwed vertically to the end of a pipe connected with a hydraulic pump and pressure gage, the pressure was slowly applied until the shell gave way. Figs. 4 and 5 show the two ways in which the break generally occurred. The results of the tests on twelve shells are shown in Table I. If we consider that the internal pressure tends to tear the shell along the greatest circumference of diameter D, the total pressure exerted endwise is:

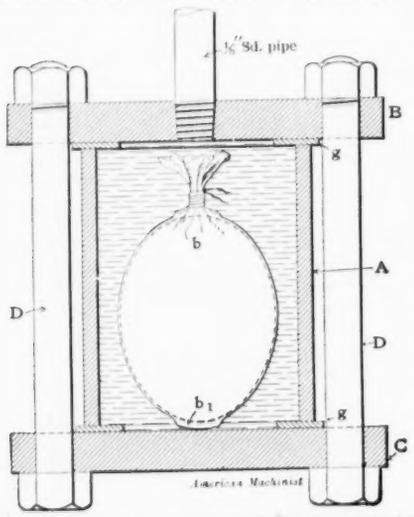


FIG. 6. APPARATUS FOR TESTING EGG SHELLS UNDER COLLAPSING PRESSURE.

$$P = \frac{p \pi D^2}{4}$$

where p is the hydraulic pressure per square inch; this is resisted by the material of the shell distributed along the circumference πD. As the thickness is t, the resisting area is $\pi D t$, and the stress f developed per square inch is:

$$f = \tfrac{1}{4} \times \frac{p \pi D^2}{\pi D t} = \frac{p D}{4 t}$$

The values obtained by this formula are inserted in Table I.

EXPERIMENTS—THIRD SERIES.

The next thing in order was to submit the shells to external pressure, and this was relatively easy. One shell being emptied, it was enveloped in a sheet of thin rubber closed and bound at one end with strong cotton string, as shown in Fig. 6. Immediately against the shell and over each hole a heavier piece of rubber $b\,b_1$ was applied as a stopper, and was kept in place by the friction and the light pressure of the sheet rubber. The apparatus for testing, shown in Fig. 6, is composed of a 2-inch brass tube A, closed at both ends by flanges B and C held by four bolts $D\,D$. Rubber gaskets $g\,g$ made water tight the junction of pipe and flanges. A ⅛-inch pipe connected the apparatus with a pressure pump and a recording gage. The shell being inserted and the air expelled, then connection being opened with the pump, the pressure was applied very slowly.

With the first shell tried, the gage on the pump reading from 0 to 320 pounds per square inch, the limit pressure was soon attained and the shell was still intact. Pressure being applied again two or three more times slowly, with care, gave a similar negative result, and the operator began to think something or someone was, in shop parlance, putting up a job on him. Disconnecting the gage, the pressure was applied suddenly and the shell gave way with a loud report. A second shell was tried in the same manner, with identical results. The experiments were then stopped in order to test the gage anew, for I firmly believed that something was amiss. The pressure gage was, however, found to be practically correct, but had to be discarded for one reading to 1,000 pounds per square inch. The third shell broke under a pressure of 675 pounds per square inch, a really astonishing fact, when one considers that the thickness is so small, the diameter relatively considerable and the material exceedingly fragile.

The greatest total pressure acting endwise on the shell is P. This pressure is distributed uniformly along the circumference of diameter D and thickness t—in other words, upon an area equal to $\frac{\pi D^2}{4}$. The pressure per square inch on this area is consequently:

$$f = \frac{P}{\pi D t} = \frac{\pi D^2}{4} \cdot \frac{p}{\pi D t} = \frac{D p}{4 t}$$

The values of f given in Table 2 have been calculated by this formula.

And now that we have found the breaking strength of a few egg shells, what conclusions can we draw from the tests? There is apparently no necessity for this great resistance, because, the shell being porous, the gases which might form inside during the hatching period or by natural decomposition, would easily escape to the outside. Besides, it has been proved that air penetrates inside and either nourishes the egg or decomposes it, according to circumstances. Consequently, it cannot be claimed that the shell must resist the force of expansion of the gases therein accumulated. Furthermore, because of its shape the egg lies always upon its weakest side. Yet it grieves one to be compelled to admit that such a remarkable thing is only a freak of nature and that our work was accomplished merely to satisfy an idle curiosity.

There is, however, an important lesson to be derived from our observations. We see that the strength of the shell depends really on its form, and if we remember this it may be of use to us in some of our future designs of machinery, such as cylinder covers, conical pistons, boiler ends and domes, etc., for which no definite rules have been satisfactorily established, and for which a great deal of judgment must be exercised in determining the dimensions.

The chemical composition of the shell of the hen's egg (according to Farmer's Bulletin No. 128, issued by the United States Department of Agriculture) is largely of mineral matter, containing:

Calcium carbonate	93.7
Magnesium carbonate	1.3
Calcium phosphate	0.8
Organic matter	4.2
	100.0

Among the various materials composed mainly of calcium carbonate are:

	Strength in lbs. per Square Inch, Tensile.	Compressive.
Plaster of Paris	160	1,040
Lithographic stone	440	4,050
Limestone	?	4,000 to 16,000

We thus see that, excepting limestone, they do not compare favorably with the egg shell, and that the latter shows a marked superiority over the others in tensile strength.

Elevator Safety Appliances—III.

BY WM. BAXTER, JR.

In the previous articles under the above heading, appliances were described that are used in connection with elevators that run on hardwood guides. Such guides are found in practice to be fully as efficient as those made of iron, but in large office buildings where a construction is desired that is as nearly fireproof as it can be made no wood can be used in the construction of any part of the elevator well; hence, in all such buildings, iron guides are used. These guides are made almost exclusively of T-bars, which vary in size from about 3-inch flange and 2-inch stem to 4-inch flange and 3-inch stem. The flange of the bar is firmly secured to the side of the elevator well, and the stem forms the guide.

With these iron guides, several forms of safety grips are used, some of which act upon the same principle as the wedge device explained in a previous article, and others on the principle of an ordinary brake, the actuating apparatus being arranged so as to increase the pressure continuously from the instant when the brake begins to act, until it arrests the motion of the car.

Figs. 1 and 3 show a safety which is

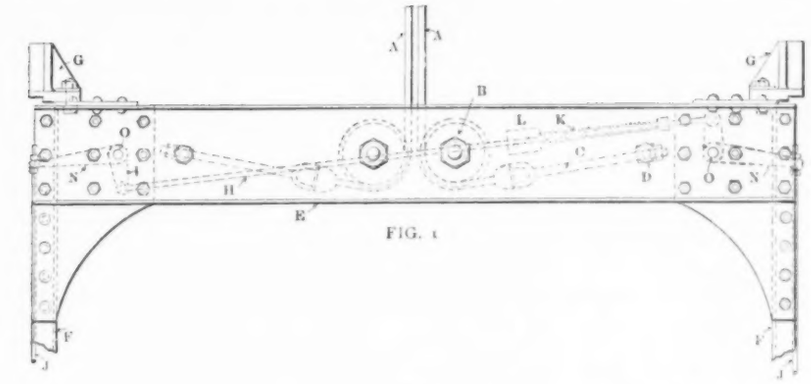


FIG. 1

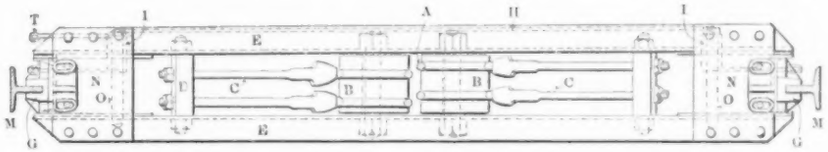


FIG. 2

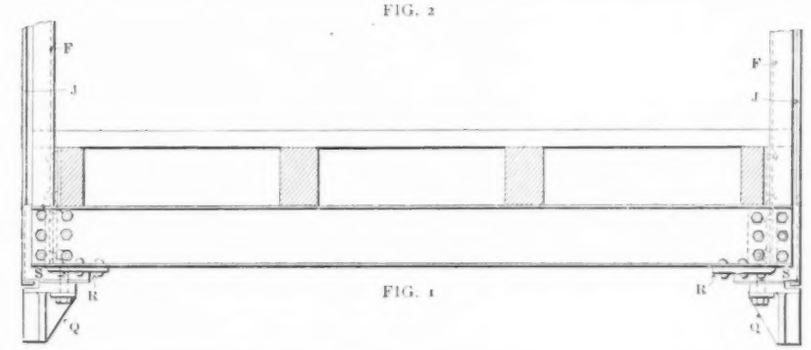


FIG. 4

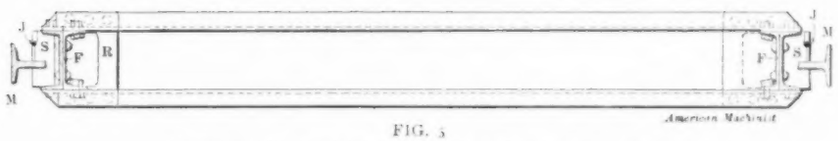


FIG. 3

GENERAL ARRANGEMENT OF THE ROLL TYPE OF SAFETY.

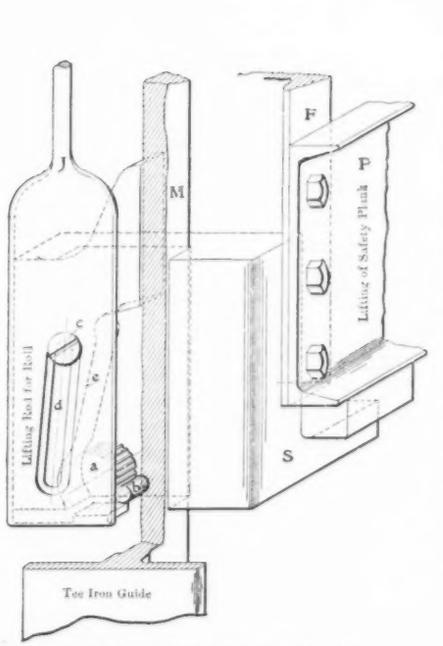


FIG. 4. VIEW SHOWING ROLL IN NORMAL POSITION.

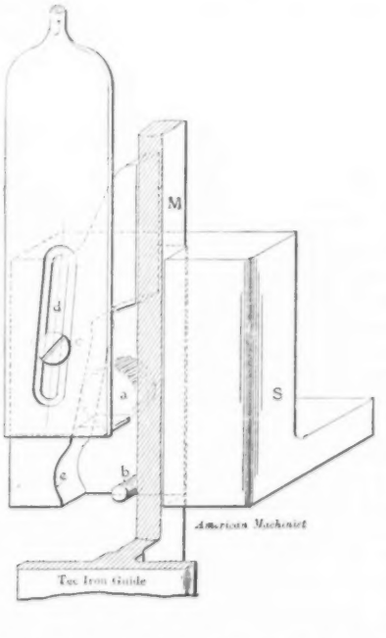


FIG. 5. VIEW SHOWING ROLL IN POSITION AFTER BEING TRIPPED BY GOVERNOR.

known as the roll type, and is a modification of the wedge device, the difference being that a steel roller is substituted for the wedge. In the drawings, Fig. 1 is divided into two parts and Fig. 2 is drawn in the gap between them. The upper part of Fig. 1 shows the cross-head or top of the frame that supports the elevator car, and the lower portion shows the floor and the safety plank under it. This safety is arranged so as to be actuated by the increased velocity of the car, exclusively. The lifting ropes *A A*, as will be seen, pass under cylindrical bearings *B B* and are secured to the ends of bolts *C*, which latter are held by bars *D* fastened to the sides *E E* of the cross-head. The construction is fully shown in Fig. 2. The T iron guides are shown at *M*, in Fig. 2, and the car is guided by means of shoes *G* and *Q* made of cast iron and mounted on top of the cross-head and under the safety plank, as shown in both parts of Fig. 1. To insure smooth running of the car the guides *M* are planed off as far back from the edge as the shoes *G* and *Q* reach, and the latter are made so as to be a free fit. The guides *M* are not planed in all cases, however.

At each end of the cross-head a rocker shaft *O* is placed which carries crank levers *I* and *N*. The levers *I*, on the two shafts, are connected with each other by means of a rod *H*. The ends of the levers *N N* support the upper ends of side rods *J* that run down to the bottom of the safety plank where they terminate in hooked ends, the hooks turning inward. One of the shafts *O* carries an additional lever *T*, as is shown in Fig. 2. As can be understood at once, if the outer end of *T* is lifted, the ends of the two *N* levers will be lifted, and thus the two side rods *J* will be raised. The outer end of *T* is fastened to the governor rope; hence, if the speed of the elevator car becomes great enough to cause the governor to act and stop the motion of the rope, *T* will be lifted and so will the rods *J J*. The castings *S S*, at the ends of the safety plank, shown in lower part of Fig. 1, and also in Fig. 3, are very massive, and have a tapered recess on the side where the rods *J* are located. When the car is running under normal conditions a hardened steel roller rests at the bottom of this recess, being held in place by the hooked end of rod *J*. If the speed increases sufficiently to cause the governor to act, and thus lift the rods *J J* the rollers will be raised until they catch between the side of the guide *M* and the side of the recess in *S*, and they will then be carried by their rotation further into the taper space, until they are wedged in so tight as to bring the car to a standstill.

The construction of the blocks *S S* and the position as well as shape of the recess in which the steel roller is contained are clearly shown in Figs. 4 and 5; the first one showing the position of the roller *a* and the lifting rod *J* normally, and the second, their position when the governor

has acted and the roller *a* has been raised into the active position. The stud *b* is provided to hold the roller away from the guide *M* under normal conditions. The lower end of *J* is guided by the screw *c* which runs in a groove *d*, cut at such an angle that the hook end will not be brought into contact with the surface *e* when the roller is lifted to the active position, as shown in Fig. 5.

As can be readily understood, the bursting strain on the block *S* is very great when *a* goes into action, and on that account *S* is made extra strong, and in addition is reinforced by the flanges of the side bars *F*, as is clearly shown in Fig. 3.

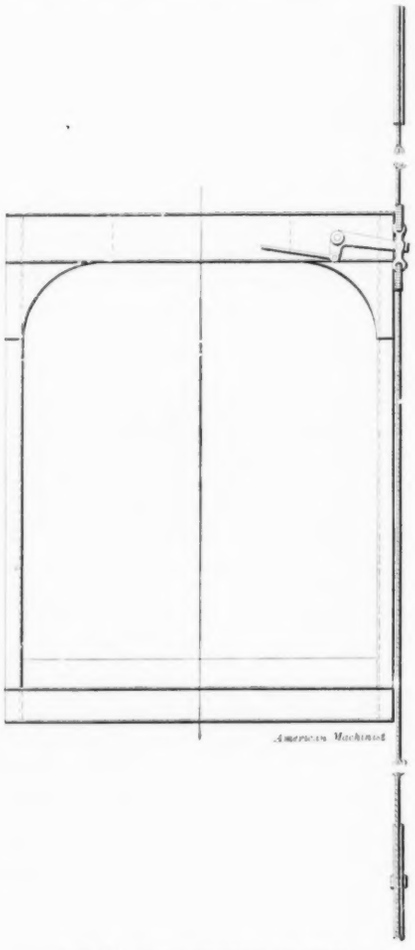


FIG. 6. ATTACHMENT OF ROPE.

In the upper part of Fig. 1 it will be noticed that the conencting rod *H* is surrounded by a spring *K* at one end. This spring presses against the end of the rod on the right side and against a stationary abutment *L*, on the left side, and being under compression, forces the levers *N* downward. The spring *K* is made stiff enough to resist all slight pulls on the governor rope due to irregularities in friction, etc., so that there is no danger of the rods *J J* being lifted, thereby throwing the rollers *a* into action, unless the rope is actually caught by the grip jaws of the governor. The way in which the governor rope is connected with the end of lever *T* is clearly shown in the simplified drawing, Fig. 6, the upper wheel being the governor wheel.

This safety device is actuated wholly by the safety governor, and if either one of the lifting ropes *A A* were to break the car would not be stopped. This fact, however, is not a defect, because as the device is actuated by the velocity of the car, it would come into action, if after one rope broke the remaining one should proove insufficient to hold the load and should give away also. Immediately upon the parting of the second rope the device would come into action, because the increased speed of the car would accelerate the velocity of the safety governor and cause it to grip the rope and lift the end of lever *T*. In freight elevators only two lifting ropes are used, so that if one should break there might be danger of the second one following suit, if the load were very heavy; but passenger elevators always have from four to six ropes, so that if one gives away there is a very small probability of any of the remaining ones following suit. The principal objection to a safety device that does not act when one of the ropes breaks is, that it permits the car to run with a loose rope dangling down in the elev tor well, and this may become caught in the other ropes, or in some other part of the apparatus and thus do a considerable damage before the elevator is stopped. If the safety will act as soon as one of the ropes breaks, the car will be immediately stopped and so will the elevator machine, because there is another safety device provided that stops the machine if for any reason the lifting ropes become slack; and, as can be seen, if the safety on the car should come into action and stop the car, the lifting ropes would at once slack up, and thus bring the slack cable stop into action.

By a slight modification the arrangement shown in Figs. 1 to 3 can be made so as to come into action when a rope breaks, as well as when the speed becomes great enough to cause the safety governor to act. A safety of this kind is shown in Figs. 7 and 8, both of which show the upper cross-head of the car-supporting frame, the first figure being a top view and the second a side elevation. Looking at Fig. 8, it will be seen that the lifting ropes *A A* are secured to bolts *B B* that pass through blocks provided with swivel bearings at the ends, these being marked *C*. The ends *C* pass through holes in side bars *D*, as is more clearly shown in Fig. 7. One of these *D* bars has its ends bent outward so as to project over the levers *F F*. These last named levers swing around the studs *K K*, and their outer ends hold the side rods *J J*. The governor rope *H* is connected with the end of one of the *F* levers by means of an arm *N* shown in Fig. 7. The two *F* levers are connected at their inner ends by means of a pin made fast in one and arranged to slide in a slot in the other, as is clearly shown in Fig. 8. From this it will be seen that when the governor rope *H* lifts the end of the lever *F*, with which it is connected, the center ends of both levers will be depressed and thus the outer end of the other *F* lever will be lifted and in that way the two *J* side rods will be raised. The bars *D* swing around the stud *E* so that if one of the ropes *A* breaks the end of *D* on the same side will be forced downward and will strike one of the *F* levers and depress it, thereby lifting the rods *J J*. The spring *L* placed around one of the studs *K* acts to swing the levers *F F* into the position in which they are drawn When they are lifted, either by the action of the governor rope *H* or by the downward movement of one end of the *D* bars, they are carried into the position indicated by the lines *g g*.

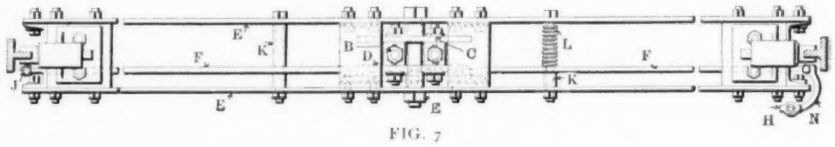


FIG. 7

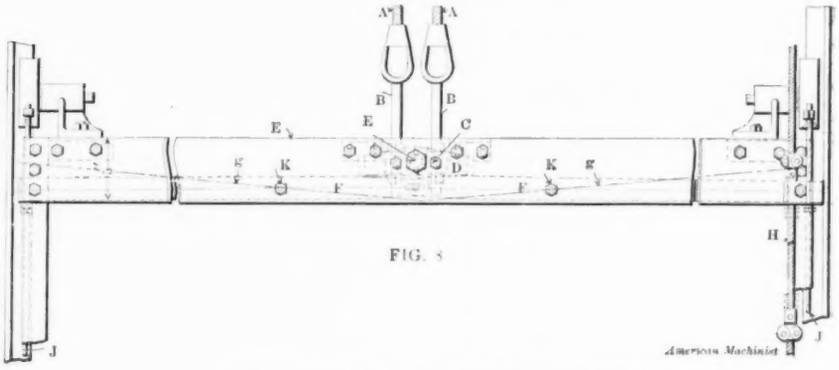


FIG. 8

MODIFIED SAFETY TO ACT WHEN ROPE BREAKS.

These drawings show a safety arranged for two lifting ropes, and, as can be easily seen, if there were four ropes and two

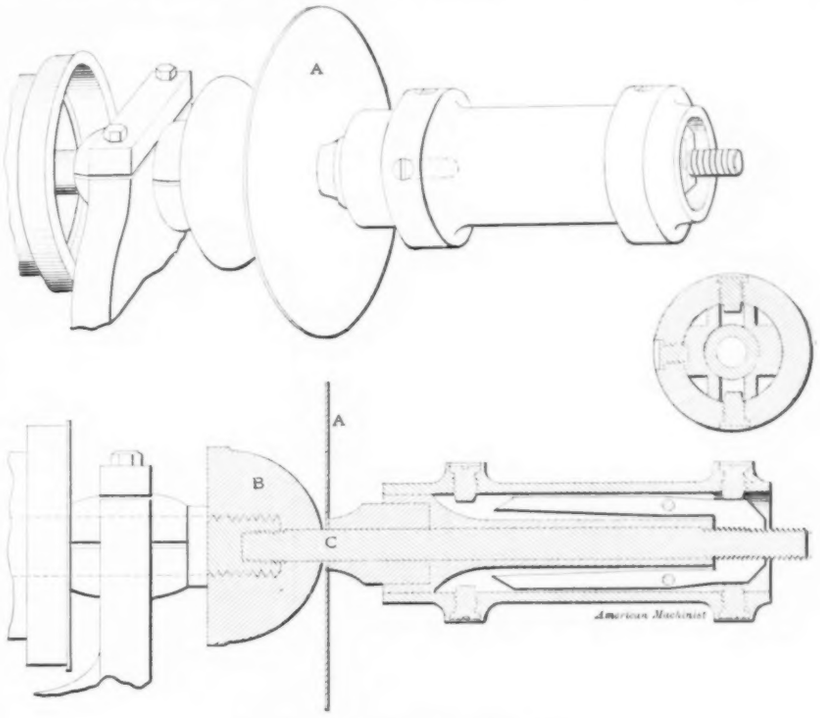
were passed through each one of the blocks that swivel around the studs *C*, the bars *D* would not be depressed at one end unless both the ropes attached to one of the blocks gave away. To make the device operative with four ropes, however, all that is necessary is to provide short cross-heads attached to the upper ends of the bolts *B* by means of a swivel joint, and then one rope can be secured to either end of each cross-head. With this construction, if one of the ropes breaks, the bolt *B* with which it is connected will drop down and thus permit bar *D* to swing around E in precisely the same manner as with the two rope construction.

The designs shown in Figs. 1 to 3 and 7 and 8 can be used with other clamping devices, as well as with the roller. If the elevator runs on hardwood guides, they can be used with the wedge safety or with the triple grip, both of which were explained in previous articles. In connection with iron guides, it is obvious that they cannot be used with the triple grip safety, and the results are not likely to be entirely satisfactory with the wedge safety. The first impression with regard to the wedge is that if it is drawn up with a moderate force it will bind so tightly against the guide as to surely hold the car, but experience has shown that unless the force with which it is pushed upward or held from moving downward is quite considerable, the pressure against the guide will not be sufficient to keep the wedge from sliding. When the guides are of hardwood, the pawl that lifts the wedge digs into the side of the guide and thus forms an abutment against which the lower end of the wedge presses, so that as the wedge cannot move further down the car rides over it and thus develops a sufficient pressure to hold the weight. It is true that by giving the wedge a sufficiently long taper it can be made to wedge in tight enough between the guide and the jaws of the safety plank to not slide down, but if it is made of such a taper it becomes very difficult to free the car whenever it is caught, and, furthermore, unless the jaws in the safety plank are made of wrought iron and massive they are very likely to be forced apart by the pressure of the wedge. The roller is far more positive than the wedge because as soon as it is caught it begins to roll upon the surface of the guide and the side *e* of the clamping block and there is no tendency whatever to slide.

It will be noticed that the shoes that guide the car are not of the same design in Figs. 1 and 8, those in the first illustration being solid, while those in the last are in two parts, one being the shoe proper and the other its support. The last construction is the most desirable for high speed elevators, as it prevents side sway of the car and conduces to smoother running. This arrangement of guiding shoes will be illustrated in another article.

A Spinning Lathe Chucking Device.

The cut, which is taken from a recent United States patent, shows a device for chucking and releasing articles of sheet metal to be shaped or "spun" in a spinning lathe without stopping the lathe. In this case the circular plate *A* is to be spun over the former *B*. This former is screwed firmly on to the end of the lathe spindle, and the straight mandrel *C* also is secured to run true with the spindle, the outer end of this mandrel having a thread cut on it as shown. The cylindrical piece *D*, with the inserted block *E* in the end, slips easily on the mandrel and has two opposite longitudinal grooves cut nearly the entire length of it. The two levers *F* are placed in these grooves and fulcrumed on the pins *G*. These levers are beveled at each end. Outside of piece *D* slides the sleeve *H*. This sleeve is held from turning on the piece *D* by the screw I, which projects into a groove *J*, the length of this groove limiting the longitudinal travel of the sleeve *H* upon the piece *D*. The outer ends of the levers *F* have inward projections which are threaded to fit the screw thread on the end of the mandrel. Near each end of the sleeve *H* are inserted screws which are adjusted so that when the sleeve is slid upon *D* their points will touch and operate the levers *F*. Supposing everything to be off the mandrel *C*, a plate to be spun is first put on and then the sleeve *H* and its contained parts are slipped on. The piece *E* touches the plate *A* and then, as the outer sleeve *H* is pushed farther on, the ends of the outer screws come in contact with the outer ends of the levers and close them on to the screw and *D* and *E* are at once forced backward and plate *A* is firmly held for the spinning operation. When *A* is to be taken off the sleeve *H* is moved in the other direction when the other ends of the levers are struck by the other screws, the piece is released and everything can be slipped off the mandrel. The sleeve *H* may be operated by hand or by any suitable mechanical device. The patentee of this arrangement is Andrew C. Witzel, New York city.



A SPINNING LATHE CHUCKING DEVICE.

Welding Copper.

We have a note from an esteemed correspondent, in which he asks us whether copper can be welded in a common blacksmith's fire as iron is. If it can be done he wants to know how, and if it cannot he wants to know why. We have a decided opinion that copper cannot be welded in a common blacksmith fire, and certainly have no knowledge of its ever having been so welded. Copper is quite peculiar in its behavior when heated. When red hot it is so brittle or "rotten" that if struck with a hammer it will fly all to pieces. If heated still hotter, or to a welding heat, in an open fire it would burn away quite rapidly. Either of the above conditions would seem to be fatal to the welding of the metal in the way suggested. Even the brazing of copper, which would naturally be thought of as a substitute for welding, is objectionable, as the heat required for brazing softens or weakens the copper near the joint, so that it is not as strong as at points where it has not been so heated, as the writer hereof knows by personal experience. If our correspondents can favor us with information in this line it would be welcome.

Casting a Round Tank.

BY R. H. PALMER.

One of a number of ways of molding and pouring a tank of this kind is shown by the accompanying sketches. The tank is 4 feet 1 inch in diameter, 24 inches deep, ¾ inch thick on the sides and 1 inch on the bottom. The casting is shown in Fig. 1. The pattern consisted of ring *D*, Fig. 2, and a section made of three boards fastened together top and bottom and held at the top the proper distance from the spindle by arm *O*.

Referring now to Fig. 2, binders *X* are seen below the floor line, also boards *Y* covering them and bolts *Z*. The spindle seat *A* is set, with spindle *B* in it and plumbed vertical. Some chimney funnels *C* are dropped over the spindle and sand is rammed up to *H*, where a cinder bed is placed, with pipes *I* to bring the vent from

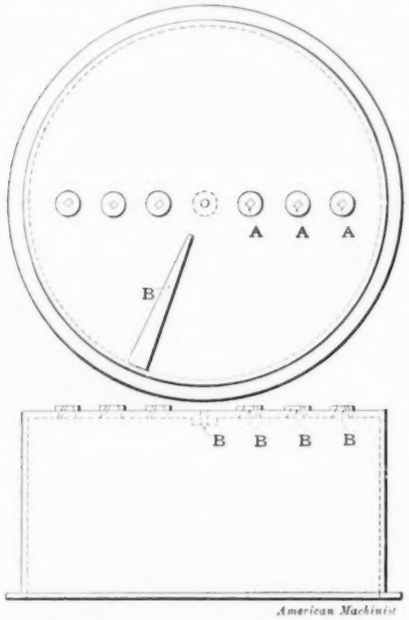


FIG. 1. PLAN AND ELEVATION OF ROUND TANK TO BE CAST.

the core above the floor. The cinders are covered with old newspaper, sand is rammed in and ring *D* is welded. Collar *F* is placed on the spindle and held by a set-screw.

The board section *E*, before referred to, is now placed in position. Arm *O*, having a hole in it to fit the spindle, rests on collar *F*. The bottom end of *E* is placed where required and board *G* is placed outside of it, with pig iron *J J* on it. Boards are set up on each side, in this way forming a triangular box, the spindle forming the apex. This section is rammed up and then the segment *E* is moved far enough along so that the next section can be rammed up, and so on all the way around, the same being rammed very hard. Section *E* is removed, and a strike conforming to line *R* is used on the spindle and the mass is trued up and the strike removed. The sand is dug away around the spindle down to piece of board *N*, or, rather, two pieces notched to fit around the spindle. The spindle is removed and a piece of board is placed at *N*, or where *N* was.

On account of the cores to be set to form the holes shown at *A*, Fig. 1, and the slot *B*, a bottom of boards had been fastened together to form a pattern of the entire bottom having on it bosses *B*, Fig. 2, and these bosses having core prints which are shown at *U*, Fig. 2.

The sand being filled into the center, the bottom *K* is bedded on top of the sand pattern, and the sides are covered with newspaper, held on by sticking nails through it into the sand pattern, and the parting made.

The cheek is now placed around the pattern and rapped down, and stakes are driven for guides. The bars in the cheek only run one-third of the depth of the cheek from within some ¾ inch of the lower joint, this amount being all that is necessary to carry the sand, and a layer of rods are rammed in higher up to strengthen it. The cheek is rammed up and vented down next to flange *D*. When the cheek is rammed up about three-quarters of the way, it is well vented around, and a layer of cinders is put over the vent holes and covered with paper, thus insuring a clear passage among the

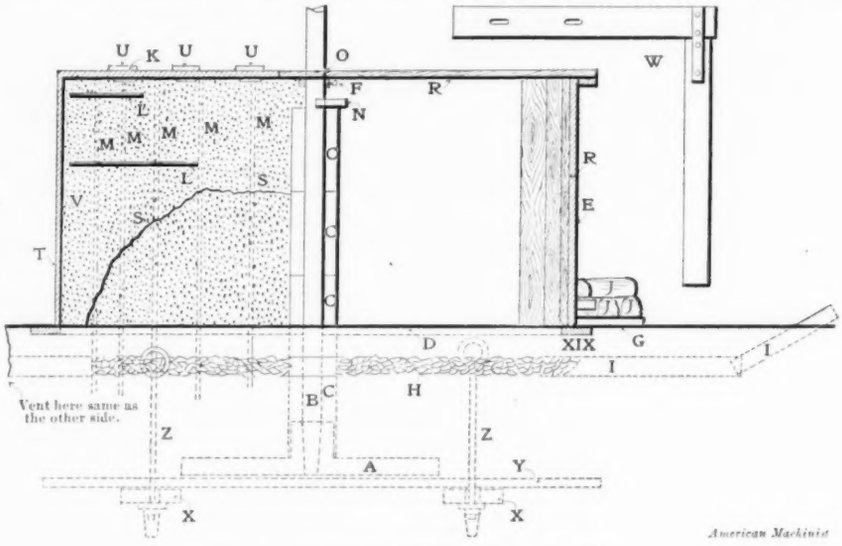


FIG. 2. SHOWING CONSTRUCTION OF MOLD.

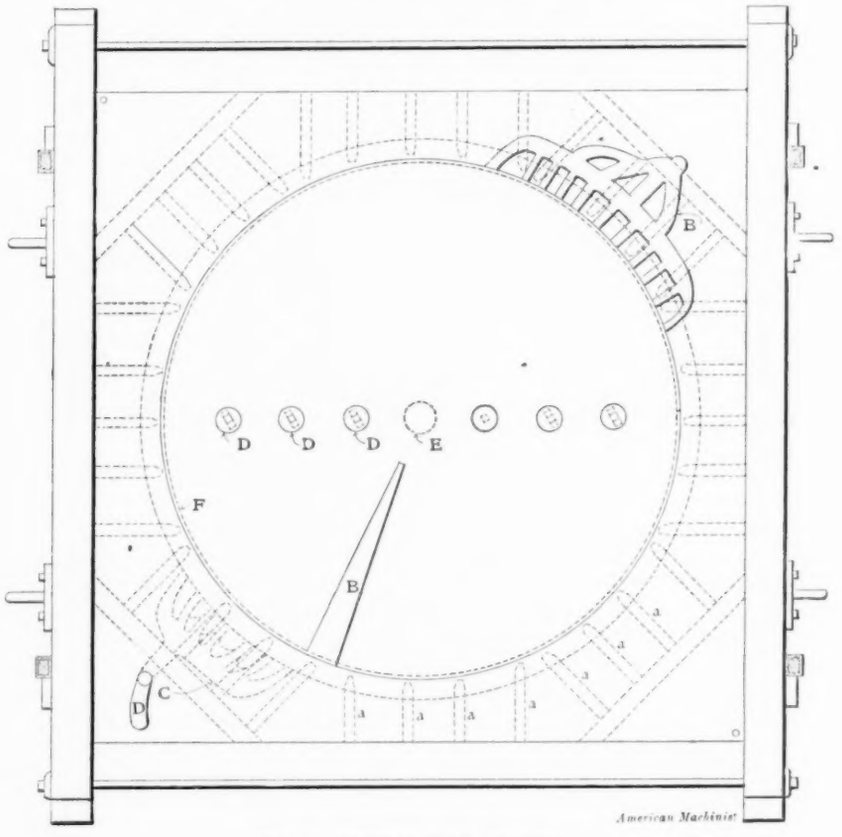


FIG. 3. GENERAL PLAN OF MOLD.

cinders for the vent to the holes in the corners of flask formed by gatesticks being rammed up in mold. When fully rammed up it is vented around down through the pap rs to the cinders, and the joint or parting is made. The cope is put on and rammed up, with gatesticks for pouring, and risers also in the corners on top of those already in the cheek, to bring off the vent.

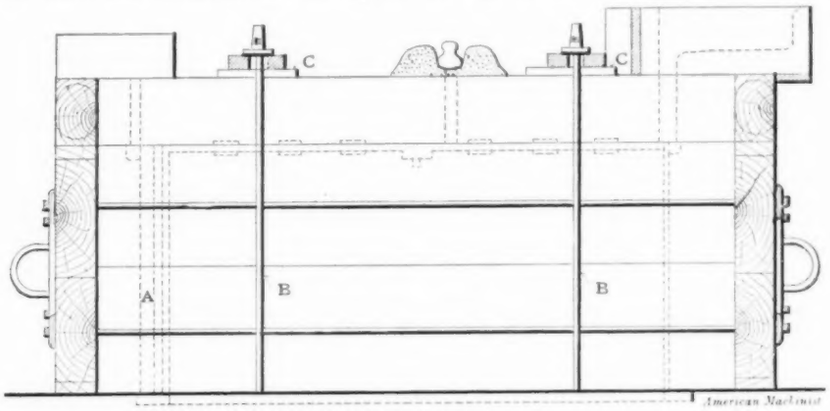


FIG. 4. END ELEVATION OF MOLD.

The cope is removed, and bottom *K* is drawn. The sand outside of line *S*, Fig. 2, to line *T* is removed, *T* forming the vertical outside line of the casting. The cheek is hoisted off, the upper funnel *C* is removed and spindle *B* and board *N* replaced. Board section *E* is again used, though moved nearer the spindle by the amount of the thickness of the casting, and secured as before. As the sections are rammed up, rods *M M* are placed a few inches from the outside, and two rows of rods, seen lying horizontally, are used in connection with *M* to tie or strengthen the core, and the sections are well vented down to cinder bed *H*.

After the core is rammed to the top of *E*, the section of pattern, or circle *E*, is removed, and the strike used in truing the sand pattern is used to true the core also, being set in nearer the center the thickness the casting is required. Care is taken that the top of core is not rammed too hard. While the sides, if proper care be taken to vent well, can, and must be, rammed firmly, to withstand the wedging or side pressure, the top must be soft enough and well vented, so that the iron may lie easily on it. If too hard and not properly vented, scabbing will be the result. On the other hand it will not by any means do to have it too soft. It is in work of this kind that the molder's sense of touch is appreciated.

After truing the sand the spindle is removed, a bunch of rags is shoved down in the hole made by the spindle and sand is filled in over them.

The board pattern of the bottom is placed on the top and rapped lightly down to give impressions of prints. It is then removed and the sand is softened up and dug out where the prints are to be. The pattern is then replaced and removed again and false prints are used to make up around for core *B*, Fig. 1 and cores *A*. Prints of *A* are seen in Fig. 2 on the under side of *K*.

The cores being set and the mold finished, the gate shown in dotted lines at *C*, Fig. 3, is cut in the lower joint into flange *D*, Fig. 2, and the cheek is closed. In Fig. 4 at *a* will be seen an upright running down through the cheek to this gate. Gate D, Fig. 3, is cut in the top joint of the cheek to connect the gate in the cope with the gate in the cheek, the two being set a short distance apart, so that the iron may not drop the whole distance at once. The main gate *B* also is cut in this joint.

The cope being placed in position pieces of board *C*, Fig. 5, are laid on it, and binders on top, thus raising the binders away from the cope so that wedges may be pushed in between bars *A*, Fig. 5, and binders *B*. The rods *B*, Fig. 4, are hooked into eyebolts *Z* in the floor, Fig. 2, pushed into slots in the binders. Washers and nuts are put on and tightened down. Wedges *A* are pushed in, runners are built and the flow off, and clay is placed in riser at D, Fig. 5.

Fig. 2 is a general view of the detailing of the mold. The right shows the making of the pattern and the left the construction of the core after the cheek has been rammed up and removed.

Fig. 3, leaving out the gates *C* and *B*, would show the cheek rammed up ready for the cope. Imagine circles *D* left out and *E* and *F* solid lines, and you would have the cheek closed on around the core inside line *F*. Fig. 4 gives an end view of the flask closed, and Fig. 5 is a top view of the mold ready for pouring.

It will be seen that the ends of the cheek are not grooved in, only butted against the sides and held in by the rods. I have moved these ends back and forth to make this cheek longer or shorter; when shorter I moved in the ends toward the center and nailed pieces of board outside them. I have used the sides with narrower ends and in a number of other different ways.

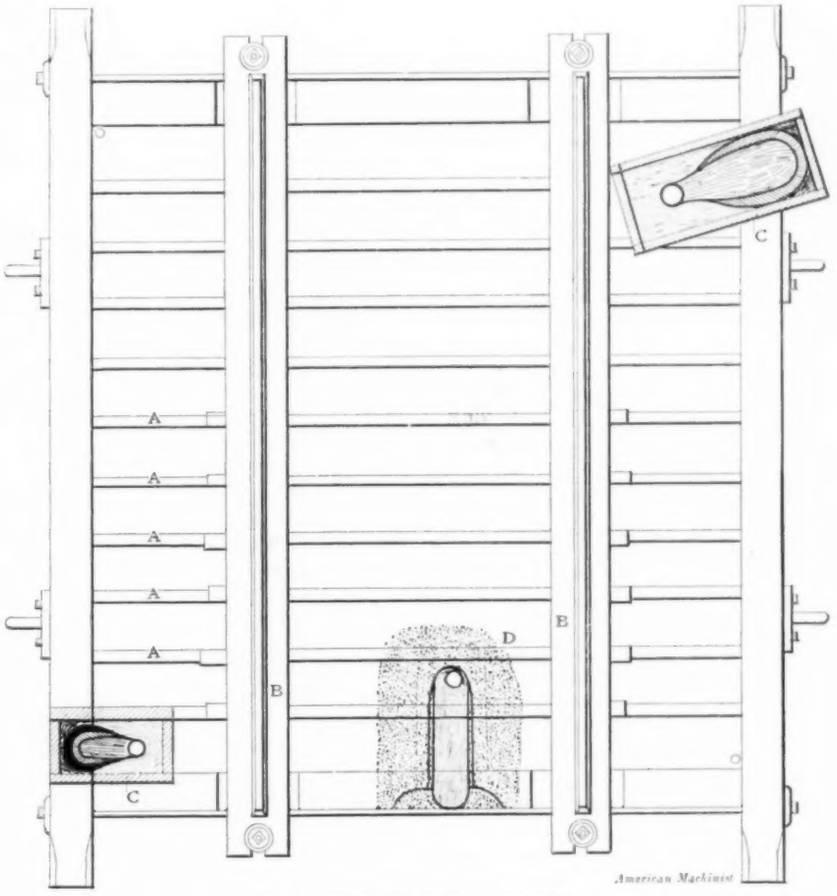


FIG. 5. TOP OF MOLD READY TO POUR.

Reducing Foundry Losses.*

BY R. C. CUNNINGHAM.

At the annual meeting of the American Foundrymen's Association held in Buffalo a year ago I presented a paper on "Foundry Costs." The ground I took at that time was that we were doing a large amount of work in our foundries which only increased our costs and did not increase our production, this unnecessary work being due to badly made and worn out patterns. The article was severely criticised by patternmakers and others in trade journals and by personal letters. One man went so far as to say that the principal reason that foundrymen were not consulted more in the construction of patterns was that very few could tell by looking at a drawing how a pattern should be made, and during his twenty-five years' experience as a patternmaker he had met only one foundryman who could read drawings intelligently. It was claimed that the paper had a tendency to create a bad feeling between foundrymen and patternmakers and there would be constant wrangling as to how patterns should be made. I certainly had no intention of saying anything to belittle the patternmaker or to provoke discord in any shop. I made the statement at the time only in the interest of the foundrymen, and I feel to-day that I am backed by a large majority in what I said.

Shortly after the convention I had occasion to visit a prominent concern. In conversation with the manager he told me that he thought my paper would do good, and wanted me to go through his works and tell him just where he could save money. He further added, "I think we are about up to date, but am willing to learn." I went into his foundry and in observing things my attention was attracted by a molder standing apparently waiting for something. While I was watching him the workman next to him passed him over his rammer. He took it and went to work. Upon investigating I found that these two molders had only one rammer, one shovel and one No. 4 riddle. Neither had a fine riddle, brush, pail or bellows, nor in fact any of the tools that are usually furnished by the company. They had quite a number of helpers in the shop. They did not give each of them a shovel. I spent the greater part of a day about the shop carefully observing the way the place was managed and I think I am safe in saying that 10 per cent. of the men did not have proper tools to work with and depended on borrowing from the other men or upon what they could pick up about the shop.

As I was leaving, the manager called me into his office and inquired if I saw anything I would have different. I told him I thought there were some things that could be improved upon. He wanted to know what they were. I told him of the things I saw in the shop. He thanked me and said, "I will look into it and I will write you." This happened about ten months ago. I had forgotten about it when a few weeks ago the following came to me:

"You will remember spending a day at our works several months ago and of expressing yourself upon how you found things in the foundry. The next day after you was here I went into the foundry to find out the truth of your statement, and I will have to admit you did not half tell it. I went into the foundry and stayed there over a week and I will say candidly I do not see how the men could do as much work as they did. In a few days every man had his supply of tools marked with his number. I stopped the molders waiting around in the morning. I had all their patterns and flasks on their floors by 7 o'clock. I have the flasks fitted before the job comes into the foundry. The molders work no harder than they did before, but we are turning out more castings and they are much better. Our expenses remain about the same, lower if anything, which shows a reduction in the costs.

"The statements you made in your paper before the American Foundrymen's Association last year were facts. Our foundries are neglected. We should pay the same attention to them that we do to our machine shops. I sincerely hope you will give us another paper on the same subject this year."

This letter comes from a man who thought his foundry was up to date, and I have no doubt that there are many more of the same mind. Now, I wish that every foundryman present at this convention, when he returns to his own home, would go into the foundry and do as this man did, stay there a week or a month if necessary (it is a good healthy place to stay), and just take notice of the patterns that come into the shop and see if the molders have the proper rigging.

See that there is no waiting for anything. Give your molders a chance and you will be surprised at the results. Now I wish every foundryman present to-day would try this and at the end of three months write me the results; no matter what they are, I would like to know how you found things in your shops. Those of you who are about your shops daily have no doubt seen and corrected everything of this kind found there, but those of you who walk through your foundry only occasionally are the ones that I want to take this to heart and bear in mind that the little annoyances are where the time is lost. They may seem small in detail but are large enough in the aggregate to increase the cost of your castings. The time when we can get more than a fair day's work from a man has gone by, and to-day every foundryman must keep close watch on his costs and production or he will find the balance on the wrong side of his ledger. . . . We must watch very carefully and see that no work is done that we get no returns for. An hour or two spent with a badly made or worn out pattern means an increase in our cost, and does not increase our production, and in order to overcome this we must figure and scheme to have things so that the molder can turn out more work. An increase in our production without any increase in our cost is what we must aim for. To do this we must study every pattern, and if we can, by making changes, make a mold any quicker we should not delay a single day in doing so.

I want to give you one illustration on this point. W have at our works a pattern for a 16-inch steam piston ring. During the past twenty-five years the company has made thousands of these rings. They were molded in the usual way. The pattern was made about one inch wider than the casting wanted, to be able to secure it on the face-plate while turning. The ring is then cut off the desired width, and cut into four segments. The actual cost of labor on one set of these castings when the rings were ready to put into the cylinder was 75 cents. The castings in the rough weighed 23 pounds. The finished casting weighed 7½ pounds. The waste piece cut from the ring that went into the scrap weighed 6 pounds. Nine pounds went into turnings. I expended $3.75 on a new pattern and plates, and am now putting these same castings into the erecting room for 4 cents a set, besides the saving on the iron. I am saving 71 cents on labor on each set of castings. The company makes probably 500 sets of these rings a year, including the new work and repairs. The saving on this job alone amounts to three hundred and fifty odd dollars. A half dozen jobs like this would pay the salary for a good man one year.

I do not claim that every job can be put on a machine on plates and the same results be obtained, but even if we can get an increase in our production of 25 per cent. without any increase in our expenses it is certainly worth trying for. Our company has put on plates during the past year over 200 different patterns, and on none of them have we made anything less than 50 per cent. saving. Any foundryman is welcome to come and inspect our patterns. We have no secrets about our shop. What we have learned by experience we are willing you should profit by if you wish.

An amusing incident happened at our works a short time ago. A foundryman was visiting our shop, and I was showing him this same pattern which I have mentioned here. After looking it over carefully he said: "It is a very fine idea, but I fail to see where you get any credit for it. According to your own statement you have cut down your production about two thirds; now, unless your firm does different from any other, you get credit only for what castings you turn out, where you formerly got credit for 23 pounds of cast-

*At the Boston Meeting of the American Foundrymen's Association.

ings, now you get credit for 7½ pounds only. It looks to me as if you were helping the machine shop at the expense of the foundry." I told him I was working for a firm that gave credit where it was due, and I think that every company should let their men understand that any improvements gotten up to reduce the costs or increase the production will be liberally paid for. It should be the aim of every foreman to encourage this among his men, particularly among the younger class. There is nothing that encourages a young man as much as it does to ask his opinion. We must remember that from among the young men we are to find our future foundry managers, and when they take the burden from our shoulders let us have the satisfaction of feeling that we exercised our ability to its fullest extent in filling up those dangerous pitfalls and removing as far as possible the stumbling blocks from their paths.

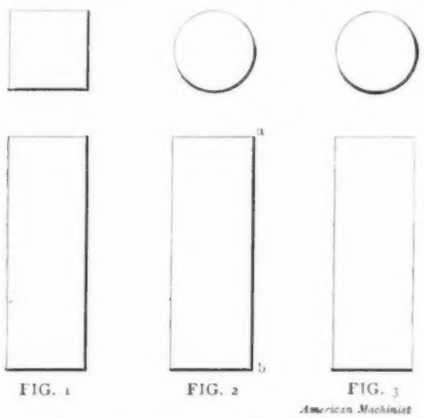
Letters From Practical Men.

Shade Lines in Drawings.

Editor American Machinist:

A great deal has been written about shade lines and perhaps a little more will not hurt.

The main object of placing shade lines on a drawing is to make it clear; therefore why is it that the majority of draftsmen place shade lines on cylinders, thus



SHADE LINES ON DRAWINGS.

making no distinction between plane and curved surfaces? For instance, looking at the elevations, Figs. 1 and 2, who can tell which one is of square and which one of circular section? In Fig. 3 we can tell that the surface is cylindrical.

Every view should convey as much information as possible; and besides being wrong, the shade line *a b*, in Fig. 2, makes it necessary to look at the plan to obtain a conception of what kind of a surface is represented.

Many will say that it is a conventional method; but is it not a mistake to adopt a method which is confusing?

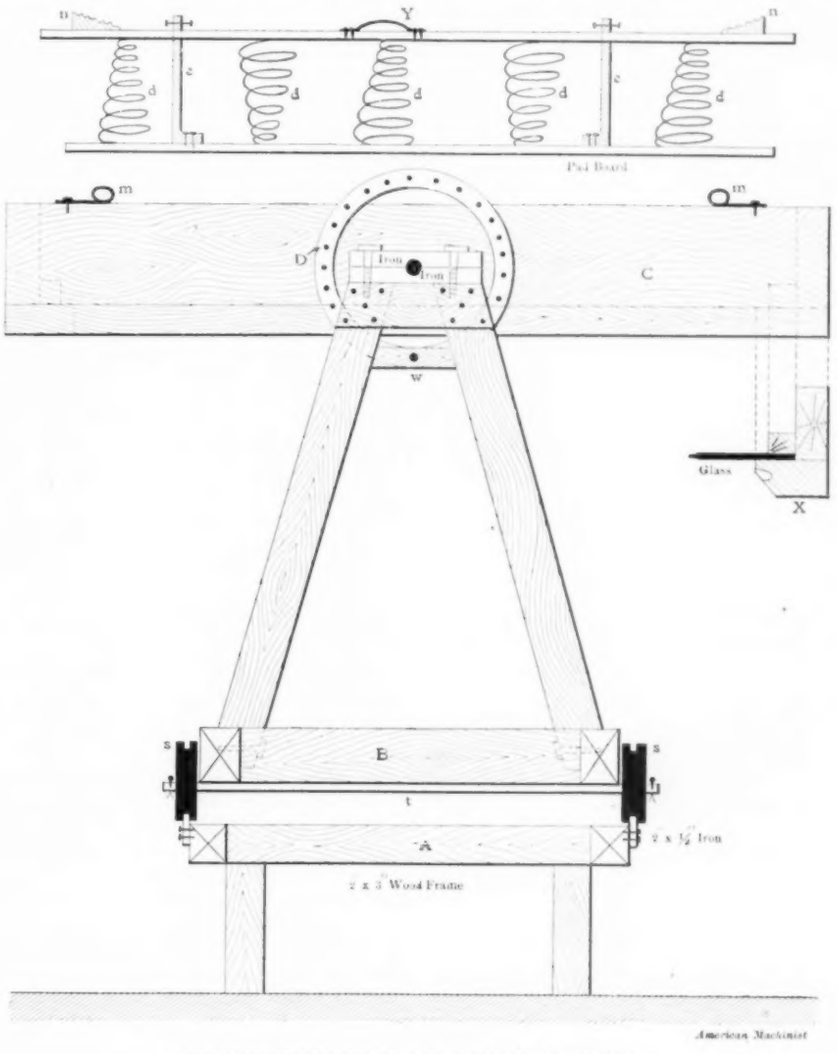
C. G. PEKER.

[Prof. Meyer always claimed that such a shade line as *a b*, Fig. 2, is wrong, because it does not define the line between two surfaces, one of which is in the light, while the other is supposed to be unlighted. In his own drawings and instructions he followed the plan substantially as shown in Fig. 2; but the generally accepted usage is to make all right-hand and lower defining lines heavy, the opposite ones light, and in practice we think the plan works very well.—Ed.]

A Blueprinting Frame.

Editor American Machinist:

Having read at page 1022 of a blueprinting frame for draftsmen, I send herewith a sketch of one of a different style.



A BLUEPRINTING FRAME FOR A NARROW WINDOW.

While it is very simple, I think that it will give good satisfaction, as it only requires a window wide enough to allow the truck carrying the frame to pass through, while the frame can be as large as the window is high, if such a large size is required.

The frame *C* is mounted on truck *B* by means of two iron shafts or carriers turning in iron boxes on the top of the truck. By means of iron ring *D* attached to one side of frame *C*, the frame can be adjusted to any angle. The ring contains any convenient number of holes by means of which the frame can be held in any position by means of a pin through hole *w* in the truck frame and any hole in the ring. The manner of holding the glass is shown at *X*. The pad board, attached to the back by the helical springs *d*, is covered by a couple of layers of any good table padding, secured at the edges of the board with tacks. The truck is mounted on four grooved iron wheels running on iron track fastened to frame *A*. This track, of flat iron set up edgewise, is long enough to accommodate the truck both inside and outside the window. The frame is of course high enough to allow the track to pass over the window sill.

To print, the back is removed from frame *C* by a rope attached to *Y* by means of a small hook, the rope running through a pulley fastened above the frame. The other end of the rope is fastened to a weight heavy enough to counterbalance the weight of the back. The tracing is then laid face down on the glass, the blueprint paper is laid on the tracing and the back is lowered and fastened by means

of catches *m* fastened to frame, engaging on graduated or stepped irons *n* fastened to the back. Thus, by means of the pad board and springs *d*, a very good contact is secured. Iron rods *e*, fastened to the pad board and running through the back, are to prevent the pad board from straining the springs when the back is raised.

This frame is especially adapted for a room with a northern or southern exposure, as the frame can then be adjusted to meet the sun at the proper angle at any time of the day. APPRENTICE.

Planer Foundations.

Editor American Machinist:

Some years ago at a shop in Ohio where I was employed as superintendent, we had an old-style 48-inch planer which was giving trouble. The machine had been set up some years before and on brick piers, and, at the time this was done, the job appeared to be a good one. The legs of the planer bed were set on top of the piers and after getting the machine level, cement had been run under the legs and neatly pointed up. However, in time the constant jarring of the machine had gradually worked the legs loose, so that when the machine reversed the whole bed jumped about a quarter of an inch. The tops of the piers were soon cracked and the planer bed got out of level so that it was impossible to do true work with the machine. Owing to the rush of business, we delayed repairing the machine until it was in such a bad condition that it became imperative that we do something at once. The following was the plan hit upon by the writer for repairing the foundations:

Measurements of the bottom of the legs were taken and a wooden pattern, as shown in Fig. 1, was made. This plate had two pockets *a a* which were formed by a strip about 1 inch high and ¾ inch thick, leaving a space around the bottom of the legs, as shown by the dotted lines. The bottom portion had a strip 1½ inches high and ¾ inch thick running around the entire outside edge of the plate. A round hole *b*, about 4 inches in diameter, was cut through the middle of the pattern, as shown. From this pattern we had five cast-iron plates made, one for each pier. The legs were all alike on the planer, except those directly under the housings. We removed the table of the planer and by means of jack-screws, raised the machine so that the legs were clear of the piers and then rebuilt the top of the brick piers, as shown in Fig. 2. The plates were then set as near level as possible on each pier and liquid cement was poured through the openings *b* until the space underneath was completely filled. The corners were also pointed up, as shown in Fig. 2. This was allowed to harden and settle for a day or two and then the planer bed was lowered until the legs set into the pockets about ½ inch below the top surface of the plates. When we had leveled the tableways perfectly, we poured melted brimstone into the pockets under each leg. This hardened in a few moments and the planer was as firmly anchored to the foundations as if they were all made in one piece. The planer ran for years after that and never got loose again nor settled in the slightest degree.

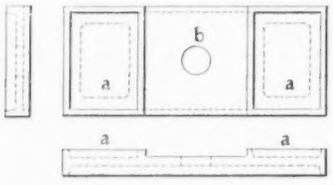


Fig. 1.

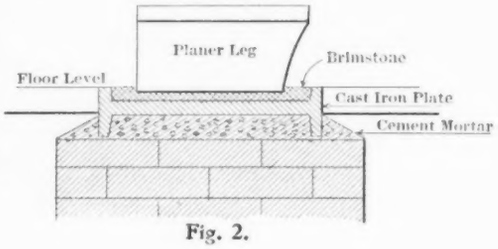


Fig. 2.

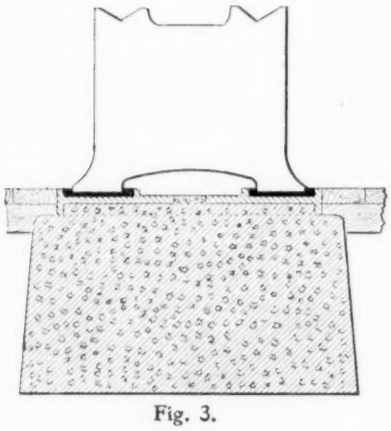


Fig. 3.

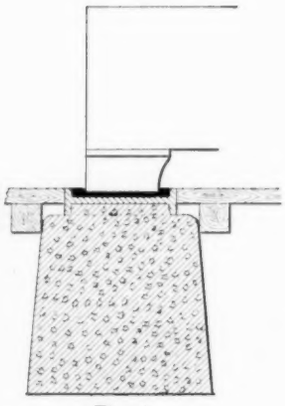


Fig. 4.

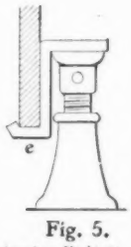


Fig. 5.

American Machinist

PLANER FOUNDATIONS.

Since that time the writer has set quite a number of planers in the same manner, and has yet to see one which has come loose. In our new works at Franklin, Pa., we are setting all our planers in this manner, except that our foundations are made of concrete, as shown in Figs. 3 and 4, which in the opinion of the writer is much better than brick. The edges of the plates make a very neat finish and the floor can be laid right up against them, as shown. I do not know that this style of foundation is new, but it has attracted considerable attention here; and I thought it might be interesting to some of the readers of the AMERICAN MACHINIST.

For the single legs under the housings, we use a plate with only one pocket and build it up in the same manner. When it is inconvenient to get a jack-screw under the planer bed on account of limited space, a bent strap *c* can be used, as shown in Fig. 5. This strap is bent so as to hook under the edge of the bed and extends upward against the side of the machine and over the top of the jack, as shown. Of course, this method of setting is not adapted for planers without legs, but the majority of planers up to 48 inches are built in this manner. L. H. COLBURN.

Brain Workers in the Shop.

Editor American Machinist:

The topic of brain workers, as touched on by Mr. Tecumseh Swift, at page 1089, opens a wide field for discussions. In a way it involves the premium or other plan, though not nearly to the extent that it does plain piece work.

There may be mechanics who do not use their brains, and I have no doubt every foreman can think of one or more who do not appear to, but in many places more brains are used than appears on the surface or is paid for. Whenever a workman devises a little kink that saves five minutes of the firm's time, the firm is benefitted by the use of his brains, and a portion of the saving should be his, as it is in the premium plan.

It sometimes happens, too, that the workman plans out ways of doing work which revolutionize the shop practice and make a revision of rates necessary, and the man who does this brain work should be paid for what he has accomplished, either in a lump sum or in being allowed to earn a good sized increase over his former wages. Even if he received the same rate and turned out twice as much work, making double pay, the firm would still be ahead, as the shop output in that particular would be doubled at no extra expense for building, light, machinery or superintendence.

I have a case in mind, of a man in a railroad shop who made the rings for metallic packing. He took the job piece work and had to hustle to make $2 a day.

Then he began to do "brain work" and devised little ways and means for helping his $2 draw interest. It wasn't long before he was making $2.50, and a little more at times. Then more kinks, and $3 daily found their way toward him. He still had ideas, but he knew he was near the limit of wages, so he waited until the man who made the rates came around again. He told him the facts—how he had enabled himself to rise from $2 to $3 without working any harder—with his hands.

"Do I dare make any more?" was the frank question. And the inspector told him to go ahead and that he would protect him in his rate, which he did as long as he was there; but he had a better opportunity and took it. What became of the rate I don't know, nor do I know how high the next jump raised the man's pay. Here is a case of brain work in the shop—or rather at home in his own time for the most part. The more such work is encouraged the better for all concerned; but let the encouragement be of the kind that will pay rent and doctors' bills, rather than only words of commendation. They go together very nicely. D. C.

Brain Work and Brain Workers.

Editor American Machinist:

Almost all of human progress in the past hundred years has been of a material kind, due to the advancement of science and invention and the consequent increase in the effectiveness of labor. Prof. Edwin Markham knows this, so does Mr. Tecumseh Swift; yet the latter, at page 1089, speaks slightingly, almost contemptuously, of such brain work as is performed by the author of "The Man with the Hoe." With the help of such men as Mr. Swift, our industrial progress has gone beyond the predictions of even the most sanguine. We have increased the productiveness of labor most amazingly, but have failed most miserably in the equitable distribution of its products. Labor produces each year many times as much wealth in its various forms as it did one hundred years ago, but the workers' share in this vast increase has been so small that many persons contend that it cannot be seen. Certain gigantic monopolies continue to grow and flourish, and they do so at the expense of the public welfare, understanding the term public to include all legitimate manufacturers and all their employees, as well as business and professional men. This condition will continue until public thought has been awakened to the injustice of such a state of affairs, and it is with a view to such awakening that "The Man with the Hoe" was written. It was to this end that Millet painted the picture.

Judging by results, the science of political economy, politics, statecraft, call it what you will, is about the most backward of all the sciences; and it will not go forward until the people waken up and push it along. Many of those who should be leaders stand as an obstruction to any advancement. We have about as much foolish legislation and as many inane political speeches, both in Congress and out of it, as we ever had. If we had shown a tenth part of the idiocy in our engineering and industrial work that we have in the management of our governmental affairs, from township to national, we should have seen our bridges sinking into the rivers they span, our tall buildings crashing down upon the heads of their inmates, and the machinery in our great mills and factories dealing destruction to both life and property, if, indeed, we had ever gotten so far as to construct anything great.

Prof. Markham's query, "How will you ever straighten up this shape?" has been humorously and tersely answered, "By giving him a better hoe." We have done this in a wonderful degree, even, as Mr. Swift says, to seating him upon a modern agricultural machine, and in effecting this improvement Mr. Swift has done his full share. But this has not solved the problem. He does not yet receive his proper proportion of the benefits of the better hoe. The condition of the working farmer, for instance, has not improved in the degree to which modern machinery and industrial advancement gives him a claim. In this connection it must be observed that "The Man with the Hoe" is not advanced as representative of the agricultural population, nor even of the lowest type of it, but as a composite type of overburdened labor in every time and place throughout the history of the world, whether in New York sweat-shops, in Pittsburgh mills, on the Western farm lands, among the Chinese coolies, or the Egyptian fellahin. This pathetic figure, standing as it does for the embodiment of the brutalizing possibilities of labor divested as completely as possible of the characteristics of brain work, and performed under conditions blunting to all the moral senses, should appeal to all to use whatever brain force they have been gifted with in the manner best calculated to advance the welfare of the race, until the picture of the Man with the Hoe represents only a condition that has forever passed from earth.

GERALD E. FLANAGAN.

The Engine Driver to His Engine.

Editor American Machinist:

The ingenious verses of Prof. Rankin, which you print at page 1063, suggest to me that many readers would be glad to see the following, also from his facile pen. They appeared originally in *Blackwood's Magazine* thirty-five or forty years ago, and caught me at once on their own merits, I not knowing then who Prof. Rankin was, and only the initials of the author, W. J. M. R., being given. I give you here a complete copy of the railway lyric and also the first stanza of its companion piece singing the praises of the old stage-coach. The versification of the latter is the smoother, but it is of course out of our line, and belongs to general literature. TECUMSEH SWIFT.

THE ENGINE DRIVER TO HIS ENGINE.

Put forth your force, my iron horse, with limbs that never tire,
The best of oil shall feed your joints, and the best of coal your fire;
So off we tear from Euston Square, to beat the swift south wind,
As we rattle along the North-West rail, with the special train behind.

Dash along, crash along, sixty miles an hour!
Right through old England flee;
For I am bound to see my love
Far away in the North Countrie.

Like a train of ghosts the telegraph posts go wildly trooping by;
While one by one the milestones run, and off behind us fly;
Like foaming wine it fires my blood to see your lightning speed—
Arabia's race ne'er matched your pace, my gallant steam-borne steed.

Wheel along, squeal along, sixty miles an hour! *etc.*

My blessing on old George Stephenson! let his fame forever last!
For he was the man that found the plan to make you run so fast:
His arm was strong, his head was long, he knew not guile nor fear;
When I think of him it makes me proud that I am an engineer!

Tear along, flare along, sixty miles an hour! *etc.*

Now Thames and Trent are far behind, and evening's shades are come;
Before my eyes the brown hills rise that guard my true-love's home.
Even now she stands, my own dear lass! beside the cottage door,
And she listens for the whistle shrill, and the blast-pipe's rattling roar.

Roll along, bowl along, sixty miles an hour!
Right through old England flee!
For I am bound to see my love,
At home in the North Countrie.

W. J. M. R.

THE COACHMAN OF THE "SKYLARK."

Ye passengers so bothered,
Who snore in rattling trains,
By dusty vapor smothered,
Awake, and hear my strains!
I'll tell you of the good old days,
Forever past and gone,
Before your pestilent railways
Had spoilt all sorts of fun—
When Joe, whose light but steady hand,
Did four high-mettled steeds command,
And well was known, through all the land,
The Coachman of the "Skylark."

Average Drawing Room Practice.

Editor American Machinist:

Referring to Mr. Coolidge's article at page 874, I would suggest drawings no larger than 18x24, for the following reasons: With drawings of this size, or smaller, a board about 20x26 can be made for each mechanic, which we will call a "drawing file." It would be part of the outfit for each vise, lathe, planer, etc., in the shop. The file could be made with four flat springs, one on each corner, all drawings being placed on these boards, which can be hung up or placed in a convenient place so the workman can see the drawing. Understand me well—*see it*, not measure it. A blueprint should not be measured. A good mechanic will not measure or use a scale on a blueprint, as he takes pride in keeping his drawings clean and free from creases. But how is he to do this when in the first place he is given a drawing to work from of the size of a circus poster, and no place to put it except over the tailstock of his lathe or on top of a tool board 12 inches square, covered with tools, etc., at the end of lathe bed, catching the drawing with his greasy hand every time he wishes to look at it, and folding it until it is impossible to distinguish a line from a wrinkle.

A general or assembly drawing can be 35x69, or twice that size, as such drawings are usually kept in the office, where there is a large board on which it can be spread out when looking it over. MACHINIST.

A Steel Hardening Salesman's Exhibition.

Editor American Machinist:

Seeing the article on the ways of salesmen by Mr. Osborne, at page 988, reminded me of a traveler who called at a shop I was connected with some years back; but in my case the article for sale was not *soft* soap but a *hard*ening mixture. It was claimed for this mixture that a drill hardened with it would easily drill a hole through a file. Our boss seemed to doubt this claim, and after a considerable amount of palaver it was agreed that if the man could accomplish this in our shop he should have an order. Accordingly I was told off to prepare a drilling machine. The file to be experimented on was an ordinary 12 inch flat, and the drill a ½-inch twist. The drill was heated a dark red and dropped into the mixture; this was repeated three times. Finally it was heated to a dark red again and dipped straight into water. The shop was soon filled with fishy smelling fumes given off by the mixture, and the men wished the traveler and his mixutre to the devil. We now made a move to the drilling machine; the file was gripped in a vise and the machine was started. There instantly arose a noise which set all our teeth on edge. The boss suggested using suds, which advice was accordingly acted upon. After half an hour's squeaking it was found that the drill point had worn completely round, and an examination of the file showed the hole to be barely a quarter way through. It is not an everyday occurrence to see a man with a silk hat and frock coat working a drilling machine. The remarks made by the men, such as "Has he served his time?" "Is he a society man?" etc., did not appear to make him very comfortable. I felt sorry for him, he seemed to have so much faith in his mixture, though to see him sweating by his repeated journeys to the grindstone and hardening furnace, and his comical appearance, was very laughable. The boss came around again after he had been at it about two hours and advised him to "chuck it." But, no, he would have that hole through if it took him all day. I had shifted off to my own job and was just thinking of going to have another look at him and trying to get him to give in, as 6 o'clock, knocking-off time, was approaching, when I was startled by an outburst of cheering. After three hours of hard work he had at last managed to get that hole through. As near as I remember he hardened that drill four times, but I lost count of the grindings. Now that the job was done he seemed to be in such a hurry to clear out that he actually forgot to remind the boss of the promised order, and got out without even having a wash. If he had wanted one he would have had to be content with washing in a bucket. Over here we have no lavatories and clothes lockers, at least not in the majority of shops. Some of the more modern shops are beginning to study the wants of the men in this respect. I don't think that traveler will try drilling holes in files at every shop where he tries to sell his mixture. CHERRY RED.

Birmingham, England.

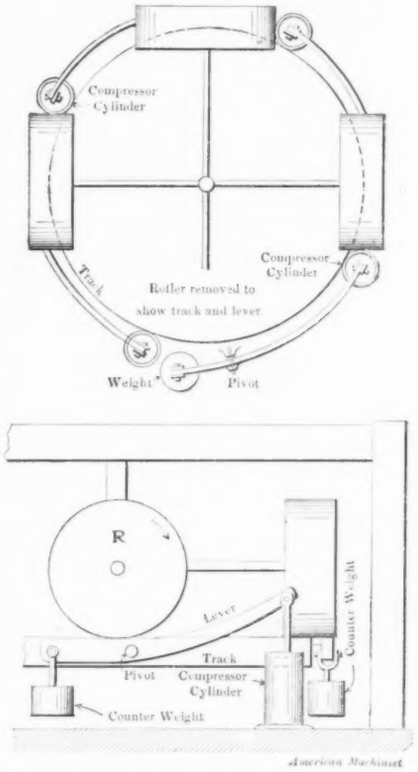
A "Power Multiplying" Air Compressor.

Editor American Machinist:

In a small shop in the Middle West, some weeks ago I found a machine that may interest your readers enough to excuse me for describing it. It was called an "air compressor," but so far as my knowledge of such things goes it stands alone.

The sketch is intended only to illustrate the principal parts and their general arrangement. The machine consists of a vertical shaft driven by a steam engine, through a suitable arrangement of shafts and bevel gears. This shaft stands in the center of a circular track about 14 feet diameter, and carries four equally spaced radial arms about 2½ feet above the track. These arms each carry on their outer ends a huge, cast-iron, cheese-shaped wheel or roller. These rollers rest on the track and are made to move around the central post more by a wondrous arrangement of chains and chain wheels than by the strength of the radial arms. No attempt is made to show the chains, as they are only a minor detail. The rollers are broad enough on the face to overhang the track and act as depressors for the air compressor pistons by over-riding the long lever attached to each piston as shown. When the machine is in motion, the rollers, moving in the direction indicated by the arrow, will each depress a piston and send a charge of compressed air through a suitable system of pipes to a reservoir common to all four cylinders. The counterweight at the short end of the lever returns the piston to its former position, ready to meet the next roller.

What I have already told may seem somewhat novel, but when you are told that the application of 10 horse-power to this machine will give a return of 100 horse-power at the reservoir, I am sure you will admit the machine is unique. On



A POWER MULTIPLYING AIR COMPRESSOR.

making some inquiry about the wonder, I was told that a real-estate man had put $15,000 into it. Possibly a *real-estate* man can get it out. WM. S. ROWELL.

[The device here shown is practically identical with one built a few years ago at Bridgeport, Conn., on a much larger scale, financial and otherwise, which we described and commented upon at the time. As long as the atmosphere endures there will probably be those who can be caught by these something-for-nothing devices for compressing it.—Ed.]

Oiling the Ways of Lathes.

Editor American Machinist:

The accompanying sketches show a way of applying oil to the ways of a lathe. Figs. 1 and 2 show a portion of the end of the carriage *C* and of the lathe bed *B*, the dotted lines showing the positions of the oil holes and of the small channels that extend beyond the bottom of the drilled holes nearly to the lower edge of

the carriage. Fig. 3 shows the cover, which is made of light spring steel and turns on the screw which passes through the hole in the center, the portions inside the dotted circles being depressed slightly as shown in sectional view. These depressions spring into the holes a little and

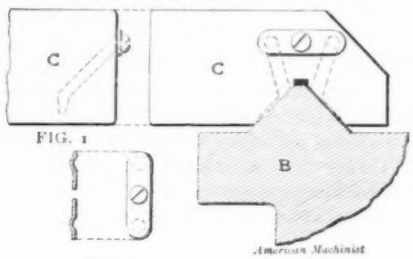


FIG. 1 FIG. 3 FIG. 2

OILING THE WAYS OF LATHES.

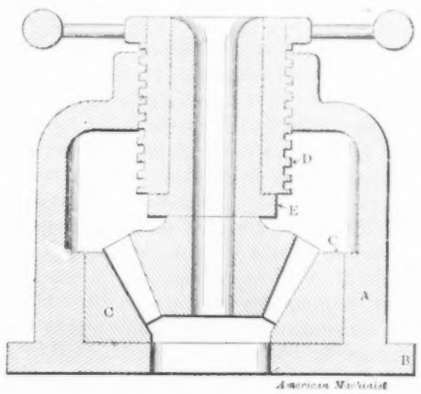
keep the cover in place. The oil when applied in this way, in working its way out to the end of the carriage, has a tendency to carry any dirt and grit that may have worked in along with it, instead of carrying it in as it does when oil is applied to the ways outside of the carriage.

M. H. BALL.

Boring Jig for Bevel Pinions.

Editor American Machinist:

A is the body of the jig and is of cast iron. It is faced on the bottom and turned at the edge *B*, so that it can be held in a chuck. The body is bored to take the tool steel piece *C*, which is hardened and ground to fit the face of the gear or pinion. It is always best to relieve *C* so that there will be but three points for the face of the gear to bear on. *D* is a machine-



BORING JIG FOR BEVEL PINIONS.

steel sleeve bored to take the tool-steel drill bushing *E*, which should be a good press fit. *D* has a coarse square thread and screws into the body freely, and is fitted at the upper end with a hand wheel. The body of the jig has an opening on each side large enough to put in and remove the gear.

In putting in a gear the sleeve is screwed up high enough, and when the gear is in place the sleeve is screwed down firmly upon it. I have used this style of jig very successfully on quite a number of different sizes of cast gears and pinions.

Hopkins, Minn. J. P. APPLEBY.

Selecting Patternmakers' Tools.

Editor American Machinist:

Apprentice boys and mechanics in general have an idea that tools made by a first-class concern are all right, but I, who have had a long experience as inspector, have an altogether different belief. I don't mean to say that the first-class concern means to turn out anything but first-class goods, but when an inspector reports for work Monday morning with a "dark-brown taste in his face" or with his liver out of order, he may pass one or two tools that are not the best, and the reader may be the one to buy one of these poor tools.

In selecting an iron plane I ask the dealer or salesman to allow me to use two 12-inch steel rules. With one I test the face to see if it is straight and also the sides. I put one on each end of the face to see if it is out of wind. I try the sides to see if they are square with the face, and I try the face to see if it is concave or convex. I put a straight-edge or a steel rule across a chisel to see if the flat side is concaved or convex, and then try whether it is straight lengthwise on the face. When I buy one or a set of wood bits I test them at the shop to see if they are to size. It is very annoying to use a bit that is over size when boring for dowel pins. I test a brace to see that it is not out of line at the chuck, also trying hand or breast drills in the same way. Good tools are worth having and the only tools to buy.

MECH.

Trade Openings Abroad.

LABOR-SAVING SUGAR AND ELECTRICAL MACHINERY IN SOUTH AFRICA—INCREASE OF THE MACHINERY TRADE IN SOUTH AFRICA—OIL ENGINES IN PALESTINE—SUGAR AND RICE MACHINERY IN FORMOSA—PUMPING MACHINERY IN EGYPT.

The scarcity of native labor, which it is expected will prove a permanent difficulty in South Africa, will have far-reaching effects on the demand for labor-saving machinery of all kinds. Indeed, it is already causing employers of such labor to have resource to mechanical devices to an extent hitherto quite unknown in that country. A good mechanical sugar cane cutter is badly wanted there, and any device at all answering requirements would be quickly taken up. At present the most promising implement of the class known is the pneumatic cane cutter used in Queen land, the introduction of which into Natal would certainly be a profitable undertaking, provided it suited local needs. I hear, too, that in some Natal sugar factories the Timewell bag filling, weighing and sewing machine has been introduced with marked success, while it is stated that its general adoption is only a matter of time.

The use of electric appliances as labor-savers in all the factories in South Africa is destined to come about rapidly. Indeed, it has already started, one firm having just laid down an electric power plant at Umhlati, drawing the power from the Umvoti River, four miles away. Electrically-driven centrifugals have already been installed in one factory—at Esperanza—and the results of their working are being watched by planters generally with interest, as belt-driven water centrifugals are always unsatisfactory, owing to the treacle rotting the belts, besides being expensive, especially when the power is generated by a pump.

Some idea of the briskness of the machinery trade in the Transvaal will be gained when I state that during the four months ended April, 1902, the imports of metals and machinery were £652,000, against £21,000 in the corresponding period of 1901; while there is similar activity in Cape Colony.

There is a capital opening for oil engines in Palestine, which are now being largely used in the orange gardens for irrigation purposes. Last year forty-seven of these engines, of the total value of £4,700, were introduced there by a German firm. Some British firms have taken up the trade and their engines have been preferred to the German. American makers would do well to note this opening.

By the way, when writing the above on sugar machinery in Natal, I omitted to state that there is also an opening in South Formosa for such machinery, and also for rice-cleaning mills, etc. The principal concern of the kind—indeed, the only one, I believe—is the Japan Sugar Manufacturing Company and also two rice-cleaning mills, both worked by the South Formosa Trading Company. Hitherto the sugar machinery has been purchased from Germany, while that for the rice mills has come from England and the United States. The company find that American prices are about 20 per cent. less than British. The Formosa Company is open to receive information concerning rice-milling machinery, sugar cane crushing and brown and refined sugar manufacturing machinery, as well as irrigation machinery.

Makers of up-to-date plant for cleaning rice might obtain orders by investigating the Porto Rico market. There is a suggestion to export East India rice thither and to erect the necessary plant for dealing with the product. The United States authorities could no doubt supply the necessary information, or the leading commission houses there.

British machinery seems to have fallen on hard times in France. In Bayonne the use of such manufactures is steadily decreasing. Its quality is not questioned and the prices are thought to be reasonable, but all the accessories, from the simplest screw or bolt upwards, have always been of a different size or intended to work differently from those made in France; consequently if the least thing failed, the piece had to be returned to the makers to be refitted, while all accessories of German and Belgian machinery are made after French models.

F. F. C.

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Naval Engineers in a Month.

There may be satisfaction of a certain kind to be derived from a realization of the very patent fact that the British Navy is no less a sufferer than at least one other which might be mentioned, through a painful lack of common sense in its management. The *Practical Engineer*, of London, in a recent issue tells the story. It has been realized by our neighbors that ships of war, however wisely designed and perfectly equipped, are not of the highest efficiency without competent engineers and enough of them. The deficiency in this department led to the appointment of a committee to make recommendations, the committee consisting of two naval captains and one chief engineer. The result was as should have been expected. As a result of their deliberations the two captains have presented a report which the engineer absolutely refused to approve. To make the supply of engineers reach farther it was proposed to relieve them of all care, supervision and operation of the hydraulic, pneumatic and electric machinery and turn all this over to executive and non-technical officers, these officers to have a course of engineering to prepare them for these onerous duties, the course to be both theoretical and practical and to cover a period of four weeks. The work of the course of study and practice which is to make of a sailor officer a competent engineer is stated in detail and embraces the following:

"Specifications for materials; working drawings; approximate estimate of the time and cost of each operation for the finished article; different metals for different parts; file work, filing round and square holes, chisels, using hammer and chisel, tools, tempers, forging, lathes, cutting internal and external threads by hand and with machine, drilling, tapping, soldering, brazing, burning pieces on a casting, making rivets, bushing holes, putting on patches, making steel and bronze nuts, electrical terminals and contact pieces, following from start to finish every operation in connection with the Whitehead torpedo, testing fractures, patterns, materials used, where procured, and price."

After a month of this a midshipman or a lieutenant could not fail to know the full details of the construction and operation of every air compressor and pneumatic hoist, every pump and hydraulic device and their connections, dynamos, motors, wires, switches and all the rest; would know how to adjust and operate for highest efficiency and prompt and unfailing service and what to do in every emergency or derangement. If there is anything deficient in the navigation of the ships or in any of the operations for which the sailor officer is distinctly and legitimately responsible, all that is necessary now is to appoint a committee of two engineers and one captain and no doubt they will prepare a scheme as wise as the above, and when it is all done it will be a tolerably complete example of how not to do it. It is not to be wondered at that self-respecting men resent such treatment as is possible under the wise direction which these little incidents indicate, and that engineers in the navy are becoming scarce when infinitely more desirable positions are open to them in the regular lines of industry.

Queer Methods on the Elevated Railroad.

It is generally known that the elevated railroads of this city are being equipped with electric traction and we often wonder if the methods which are outside the ken of the casual observer are as left-handed as those which are in sight.

When the rails for the third or conductor rail were distributed on the structure they had not been straightened at the rolling mill, being in the crooked condition in which they came from the rolls—a condition which is perhaps best expressed by the words once used by Mark Twain—"Straighter than a corkscrew, but not as straight as a rainbow." Distributed in this condition they were then laboriously straightened by hand—gangs of workmen being occupied for weeks in using hand-worked, portable hydraulic presses and straightening rigs.

An even stranger thing may now be seen in connection with these same rails. Holes are required through the webs of the rails for bolting boards to their sides—these boards being spaced apart by thimbles or blocks on the bolt shanks, the arrangement forming a trough in which the rails lie, the office of which is to protect the workmen engaged on the structure from coming in contact with the rails. The rails were distributed without these holes having been drilled, and to-day, with the rails in place, gangs of men may be seen—a dozen or so in a row—laboriously pulling ratchet drills in making these holes. The holes are spaced—judging by the eye—at a distance apart of about four feet—certainly not more than that. The aggregate length of the lines we do not know, but, remembering that two of the lines are triple tracked, there can hardly be less than from seventy-five to a hundred miles of this third rail to be drilled with holes every three and a half or four feet. There can thus hardly be less than a hundred of these holes. It has been suggested that perhaps the provision of the trough was an afterthought, but this is not a creditable explanation. It is as, and more, unpardonable to have overlooked the need of the protection supplied by the trough than the need of the holes to bolt the boards in place.

The stations of the West Side lines at 116th and 125th streets are between the tracks and both arriving and leaving passengers pass lengthwise through the stations past the ticket booths. Originally these booths were so located that the two streams of passengers passed one another by going to the right in accordance with universal American custom. When addi-

tional stations were erected at these stopping places to separate the traffic of the Sixth and Ninth avenue lines, the ticket booths of the original stations were taken down and changed to the opposite side, thus compelling every passenger to reverse the habits of a lifetime and turn to the left. The case was not one of original oversight, as the stations were originally correct, but a case in which the man who had the work to do was apparently determined to be wrong. Stranger still, the new stations for the Sixth Avenue trains were made as they should have been, and as matters are now a passenger for the Sixth Avenue line must turn to the right while one for the Ninth Avenue line must turn to the left!

The traditional Chinese puzzle is to us a simple thing compared with the management of our elevated railroads.

The Strength of an Egg Shell.

The record of the tests of the strength of egg shells which we publish in another column will appear at first sight to be foreign to the science and art of machine construction. But no designer of machinery can possibly know too much about the strength of materials, and especially about the forms in which materials may be disposed to give different degrees of strength. It has long been known that the egg shell possessed great strength to resist compression stresses, but no one has until now known how much strength it possesses. This information is now before us, thanks to the genius for testing manifested by Mr. Guy, whose original and striking work in the investigation of the behavior of beams under loads we published last year. However it may seem at first glance, nothing that this young man is likely to do can safely be neglected by him who would be well informed on subjects of interest and value to those engineers and mechanics whose duty it is to design the safest and most serviceable structures or machines possible. Such is, indeed, Mr. Guy's regular work. He conducts his tests as a recreation.

Standard Trade Catalogs.

We are glad to co-operate with our esteemed contemporary, *Engineering News*, in promoting the adoption of the standard size for trade catalogs, and we can do this in no way more effectively than by reproducing its recent editorial utterance upon this really important topic. It will be noticed that we differ from it in the spelling of the word catalog. Our way is fully authorized, is simpler, is American, and would seem to be the fitting associate for the standard American dimensions. *Engineering News* says:

"The movement for the adoption of a standard size of trade catalogues can perhaps be hardly called a movement, as its progress is so very slow. Nevertheless, we believe that some advance is being made toward uniformity, and that the proportion of 6x9-inch catalogues is increasing year by year. The surprising thing about the whole matter is that manufacturers and dealers in engineering supplies should be so blind to their own interests. When a firm has invested thousands of dollars, more or less, in publishing a catalogue, it is manifestly for its intetrest to have that catalogue made use of by its customers and not thrown away or stowed in some obscure corner where it will be forgotten. Yet when such a firm permits the manager of its publication department or its printer, or whoever has charge of the matter, to make a catalogue of some odd size, perhaps too high to stand on an ordinary shelf or of greater width than hight, so that it refuses to go with others in a proper classification—when it commits such a piece of folly, it is deliberately consigning a large percentage of these expensive catalogues to the waste basket or to the top shelf, where they will be forgotten.

"We wish the publication manager of every firm dealing in engineering supplies could have indelibly impressed on his mind the fact that there are several thousand engineers and business firms in this country who are large purchasers of supplies, and who systematically file for reference every good trade catalogue in their line which they receive, provided, of course, that it contains matter worth referring to, and provided also that they have a place to put it. If a catalogue is 6x9 inches, there is always room for it. If it is one of the odd sizes that refuse to associate with any other books or pamphlets, it may find a place or it may not, but in either case it cannot be classified in its proper place in the catalogue file, and will very likely be missing when the time comes that something is to be bought in that particular line.

"If there is any reason why at least 99 catalogues in every 100 could not be made exactly 6x9 inches we have yet to hear it offered."

Inquiry for Machinery.

(163) We have an inquiry for the name of a firm making machinery for the manufacture of sandpaper.

Some New Things.

PIPE WRENCH.

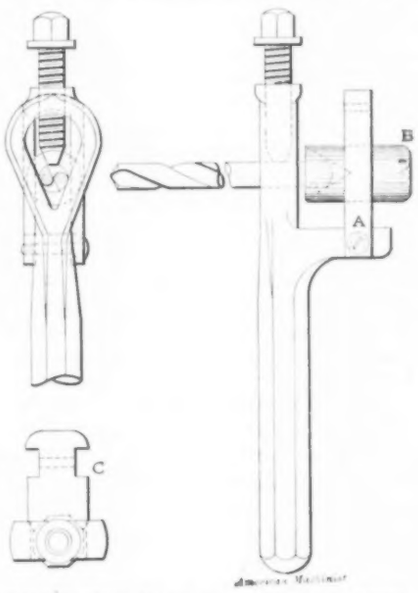
The illustration shows a new pipe wrench brought out by W. H. Ermentrout, 514 Elm street, Reading, Pa. In this wrench the movable jaw is in the form of a steel roll, provided with teeth as shown and mounted on a pin at the front of a sliding sleeve carried on the handle. A stiff spring inside of the handle forces this sleeve down toward the head of the wrench. At each side of the roll is a pinion, the teeth of which engage with rack teeth on the body of the wrench. When the wrench is placed on a piece of pipe the spring in the handle presses the roll against the work. The wrench then being turned in the proper direction, the gripping roll, through the action of its pinions meshing with the racks below, will be forced down hard against the pipe, and the harder the pull on the handle the

PIPE WRENCH.

tighter will the work be gripped. Three sizes of wrenches are made; the 10-inch size takes from ⅛ to ¾-inch pipe, the 18-inch from ⅜ to 1½-inch pipe and the 24-inch from ¾ to 2-inch pipe.

COMBINATION HAND-DOG AND SUB-CENTER.

This device is designed for holding small drills, reamers and taps, or small work that is not provided with centers. The



COMBINATION HAND DOG AND SUB-CENTER.

body and handle are forged in one piece, and a projection is formed at the back for carrying the guide *A* in which is held the sub-center *B*. The guide fits in grooves milled in the sides of the projection, as shown at *C*, and is thus prevented from swinging. The sub-center is made of drill

rod milled across on opposite sides to fit in the guide, and can slide up and down to accommodate various sizes of drills. The drill is pushed back into the center as shown and clamped securely by the set-screw. This tool is the invention of Willis G. Young, 323 Brown street, Dayton, O.

Charles M. Schwab.

Twenty-two years ago he entered the Carnegie works as a stake driver at $6 per week; prior to that he had been a clerk in a grocery store at less wages. But he was by no means uneducated. He had received a somewhat liberal education at St. Francis' College, and was especially proficient in mathematics. For the benefit of boys who dislike mathematics and see no use in the study, it may be added that Schwab's knowledge of mathematics is one great secret of his success. That knowledge enabled him to become an engineer in short order, and it has served him also in the study of the sciences, particularly those relating to metal making. His rise was rapid; he accomplished most difficult tasks in engineering, was fertile in invention and ingenious in effecting economies. He became an invaluable employee, then a partner and stockholder, and then president of the great corporation known as the Steel Trust. During all his years of hard work Mr. Schwab never suffered from nervous prostration, and if he had not become extremely wealthy, he would not now be traveling for the benefit of his health.

Was it worth while to become possessed of $25,000,000 for this? Mr. Schwab would have been much better off if he had continued at his congenial labor, reaping therefrom only a small fortune, for then he would have been contented to have stayed in the healthful mountains of Pennsylvania. It was his money that led him to New York and Paris, and it was in these places that his nerves were shattered, not by his useful labors in the steel works or in the offices of his corporation, but by rich living, to which he was unaccustomed. He has been a very useful man; his life presents encouraging features for every poor boy of ability.—*Philadelphia Ledger.*

A Heavy Autotruck.

One of the heaviest autotrucks in daily, practical use has been built by the Fischer Motor Vehicle Company, Hoboken, N. J., for a brewery in this city. This has carried 83 half-barrels of beer, or nearly 9 tons. It hauled a 7½-ton load 12 miles one-third of which was uphill, the grade reaching 15 per cent. at one point. It cost ¾ cent per ton mile for gasoline to haul the load the 12 miles. The following are the principal dimensions:

Total length, 18 feet 4½ inches; width inside stakes, 5 feet; width over hubs, 7 feet 6 inches; wheel base, 10 feet 6 inches; wheels, 36 inches and 42 inches with solid rubber tires.

The power equipment consists of a four-cylinder 5½x6-inch gasoline engine coupled direct to a 9-kilowatt 110-volt dynamo running at 550 revolutions per minute, approximately. There are two motors of 8 horse-power each capable of an overload of 150 per cent. A storage battery which is a part of the system consists of forty-four 136 ampere-hour cells (3-hour rate). The controller has five speeds each way, the maximum speed of the vehicle being 4½ to 5 miles per hour with full load.

It is announced that the J. A. Fay & Egan Company and the Lane & Bodley Company, of Cincinnati, are planning the erection of a building for the use of their workmen. As described in the daily papers, it is to be something in the nature of a combined boarding house and restaurant, to be so conducted that it will take the place of the usual saloons and boarding houses which spring up in the neighborhood of large shops. Everything offered by the saloon will be provided, but in a more attractive way, and it is the intention to offer everything at a price so much less that no ordinary saloon in the neighborhood will be able to compete. The companies expect to derive a benefit by securing better men by the attraction of better meals and more attractive rooms.

Obituary.

Robert White, founder of the Robert White Engineering Works, Brooklyn, N. Y., died August 18, fifty-nine years old. Mr. White was a native of Scotland and came to Brooklyn in 1864. He started his shop in 1874, and had just begun the erection of extensive works upon another site.

Personal.

John M. Saalfrank, foreman machinist of the American Brass & Copper Company wire department, Ansonia, Conn., has severed his connection with this firm to take a position as foreman of the assembling department of the E. J. Manville Machine Company, Waterbury, Conn. Just before leaving Ansonia, the employees of the machine shop presented Mr. Saalfrank with a very handsome gold watch and chain suitably engraved with the names of the givers and the recipient.

Commercial Review.

NEW YORK, Monday, Aug. 25.

As predicted in these columns several weeks ago, the bids submitted to the water authorities of Greater New York for the establishment of a pumping station at Baldwins, L. I., have been thrown out. It will be remembered that there was only one bid for the complete plant, submitted by M. T. Davidson, of Brooklyn, N. Y., which was for $67,800, and only one bid for the boiler equipment by A. D. Granger, of New York, which was for $11,950. The Holly Manufacturing Company, Henry R. Worthington and the Snow Steam Pump Company were also bidders, but their bids were not recognized, because they were not accompanied by the customary check deposit prescribed by the city charter. The reason why the bids were thrown out cannot be ascertained. The city authorities simply say they are acting within their authority, and for the best interests of the city. On the other hand, it is stated that the proposals will be advertised for the fourth time because of friction between the water authorities of the boroughs of Manhattan and Brooklyn. When new bids will be opened has not yet been determined.

The incident recalls the growing reluctancy manifested by manufacturers to bidding for city contracts. Here is a pumping contract aggregating $100,000 in round figures, and yet only three bidders compete for it, the three concerns whose bids were not considered forming constituent companies of the International Steam Pump Company, and in reality only entitled to being designated as a single bidder. There ought to be at least a dozen bidders. The reason why manufacturers do not seek city contracts is because of the numerous difficulties encountered in their execution. In the first place the specifications are drawn with considerable preciseness, and not always for the purpose of subserving the best interests of the city. Then the authorities always arrogate to themselves the right, or charters vest them with the power, to reject any and all bids submitted, and as a result bids are rejected for reasons which would not stand investigation at the hands of twelve men "good and true."

Even if the bidder manages to escape these difficulties and is awarded a contract, his troubles begin. Starting in to do the work, he is surprised at the numerous men who "inspect" it. These gentlemen, as a rule, are very fastidious. Still the objections they raise, even though numerous, although rarely weighty, are not insurmountable by any means. They generally yield to a certain kind of an argument, and this doesn't always take the form of a vocal or written communication. That's too commonplace. When the work is completed, other disadvantages make their appearance. The city keeps a good-sized portion of the payment as a guarantee that the work has been done properly, and retains the sum generally a year. Then payment is deferred for an unreasonable time, and in many cases to such an extent that contractors have been known to go into bankruptcy with the city owing them enough money to meet all of their outstanding obligations. Under these circumstances redress lies in litigation. This is so extensive that one large law firm in New York has practically no other cases on its books. It usually happens, however, that "pull" and "graft" accomplish good results, particularly the latter. These

observations do not apply to any particular municipality. They are general, and because of the fact, manufacturers, as before stated, are averse to bidding for city contracts. Business men want to be dealt with in a business way. They don't seek special favors. They wish to act honestly, and to be treated accordingly. They are averse to "pull" and "graft" being put in their lexicon or added to their vocabulary.

Recent sales of importance by the Chicago Pneumatic Tool Company include two large compound compressors for the New York Central & Hudson River Railroad Company's Jersey Shore shops; two large compound compressors for the Readville shops of the New York, New Haven & Hartford Railroad Company; a compound compressor of 2,000 cubic feet per minute capacity for the Lake Shore & Michigan Southern's Collinwood shops, being a duplicate of the first compressor installed; a 1,000-foot compound compressor for the St. Louis, Iron Mountain & Southern Railroad. Other sales include five large-size straight-line compressors to the American Lime & Stone Company, Tyrone, Pa.; a 1,000-foot compound compressor to the Mobile & Ohio Railroad, for their shops at Mobile, Ala., and one of 500 cubic feet capacity to the Louisville & Nashville Railroad.

The Lidgerwood Manufacturing Company, of No. 96 Liberty street, have received an order for a cargo unloading triple cableway to be installed at Manaos, Brazil. The company is also in receipt of some good orders for its hoisting engines, especially in this vicinity, in consequence of the extensive building operations that are going on.

The Steam Boiler Equipment Company, of New York, of 20 West Houston street, New York, announce that many plants in New York and other cities have been burning soft coal without any objectionable smoke for one to three years. They have successfully equipped factories, hotels and office buildings in New York, Philadelphia and other cities, with their Hydrocarbon System and made practical and satisfactory tests for the smoke inspectors, showing economy in fuel and increased evaporation.

The Pittsburgh Gage & Supply Company, Pittsburgh, are furnishing two 125 horse-power boilers to the Cadiz Electric Light & Power Company, Cadiz, Ohio, besides giving their power plant a general overhauling. For the Sleepy Eye Milling Company, Sleepy Eye, Minn., a complete oil-filtering system. The company has in press a new general catalog of some 686 pages which will be a complete exposition of illustrations, descriptions and price lists of general machinery and supplies. The book will be ready for delivery about September 1.

Mr. A. Tait, assistant manager of the works of Messrs. George Angus & Co., Ltd., Newcastle-on-Tyne, England, one of the largest leather manufacturers of the United Kingdom, recently spent two weeks in Syracuse, N. Y., having come to this country specially to visit the works of the New Process Raw Hide Company. An arrangement was made with Messrs. Angus & Co. by T. W. Meachem, president of the rawhide company, during a recent trip abroad, whereby the English concern is to establish a plant in England for the manufacture of rawhide gears and other products under the patents and secret processes of the New Process Raw Hide Company and using the latter company's trade-mark. This plant, it is expected, will take care of the company's business, not only in Great Britain, but throughout Europe, Messrs. Angus & Co. having offices in nearly all of the principal cities, and therefore being excellently situated to care for this trade. Upon Mr. Tait's return to England, he will place orders with American firms for the latest gear-making machinery and will proceed at once with the fitting out of the new factory, which will also be located at Newcastle-on-Tyne. Messrs. Angus & Co. have been the agents of the New Process Raw Hide Company in Great Britain for eight years.

The General Electric Company, Schenectady, N. Y., have received an order from the Baltimore & Ohio Railroad for two of the most powerful electric motors ever built. Each of the motors will weigh 150 tons and will have a hauling power of 1,500 tons, exclusive of its own weight, up a 60-foot grade at a speed of ten miles an hour. The contract price for these motors is about $70,000, or $35,000 each. The motors will be constructed on the unit system, and each motor will consist of two units of 75 tons each. One is to be delivered in about nine months and the other in ten months.

The Buffalo Forge Company, Buffalo, N. Y., have recently received the following orders: Two 70-inch steel plate steam fans, for heating and ventilating, direct connected to two Buffalo Forge Company engines, and one 130-inch ¾ housing standard steel plate pulley fan for mechanical draft, to be shipped to Copenhagen, Denmark; one induced draft plant and one 23 horse-power engine for electric light plant in Dutch Guiana, South America; five Buffalo engines of 45 horse-power each for driving generators, and one 38 horse-power engine for a pumping equipment to be installed in a sugar factory now being built near Manzanillo on the south side of Cuba; one 20 horse-power Buffalo vertical class A engine, to be shipped to Gustenunde, Germany; one 15 horse-power double vertical single-acting Buffalo engine, to Gothenburg, Sweden; one 60-inch standard steel plate fan for ventilation, to be shipped near Glasgow, Scotland; one 140-inch steel plate fan with heaters complete for heating and ventilation, to Barrow-in-Furness, England; one standard 80-inch fan and heater complete and one 90-inch pulley fan for ventilation and one 30 horse-power horizontal Buffalo engine, to London, England, and one 120-inch fan and six 60-inch fans, to Manchester, England; one 80-inch standard steel plate fan for mechanical draft, to Victoria, British Columbia; one 110-inch steel plate pulley fan direct connected to a cylinder above shaft Buffalo engine for mechanical draft, to Halifax, N. S.; one 70-inch fan and one 100-inch fan for heating and ventilating purposes, to Portland, Oregon; one standard 40-inch steel plate fan, to College Station, Tex.; one 100-inch steel plate fan direct connected to a Buffalo single vertical engine, to San Francisco, Cal.; two special 60-inch steel plate fans, to New Orleans, La.; and one 25 horse-power horizontal Buffalo engine, to Gretna, La.

Consul Frank D. Hill, of Amsterdam, under date of July 24, 1902, writes that it would be advisable for exporters of iron, steel, coal, and electrical supplies to send catalogs to that consulate, as he intends to devote a room exclusively to circulars of American firms, folders of American railways, steamship lines, cable companies, etc. He has received many visits of late from people interested in the import trade and they desire data in regard to United States industries. Reports of chambers of commerce would also be useful.

American electrical apparatus is making remarkable progress in European markets. The Société Anonyme Westinghouse has found it necessary on account of the great number of orders to make extensive additions to its plant, which has been in operation for only five years. This plant is located at Havre, France, and supplies the territory included in Holland, Belgium, Italy, Switzerland, Spain, France and their colonies and protectorates.

The American Fork and Hoe Company, recently organized in New Jersey, with a capitalization of $4,000,000, announces that it will make a specialty of the manufacture of pitchforks. We do not notice the name of Senator Tillman among the incorporators.

The Allis-Chalmers Company has received an order from the Southern Electric Light Company, of Philadelphia, for a Reynolds combined vertical and horizontal engine, having a minimum capacity of 8,000 and a maximum of 12,000 horse-power. The engine will almost be a duplicate of the eight engines now in the power station of the Manhattan Elevated Railway at Seventy-fourth street and the East River, this city, and of the eight engines to be installed by the Subway at Fifty-ninth street, this city.

The Triumph Electric Company, of Cincinnati, Ohio, reports business to be unusually good. Recent orders received by it include the following: The Krell French Piano Company, Newcastle, Ind., one 200-kilowatt engine-type direct-connected generator and fifty-six motors of sizes from 5 to 40 horse-power aggregating 520 horse-power in motors; The Wooster

University, Wooster, Ohio, two 100-kilowatt and one 50-kilowatt engine-type direct-connected generators; The Kanawha Valley Traction Company, Charleston, W. Va., two 125-kilowatt belted type of generators; Eastern Kentucky Asylum for the Insane, Lexington, Ky., one 75-kilowatt engine-type direct-connected generator and a 15 and 10 horse-power motors; United States Printing Company, Cincinnati, one 100-kilowatt engine-type direct-connected generator; Nordberg Manufacturing Company, Milwaukee, Wis., one 100-kilowatt and a 60-kilowatt belted generator; the Globe Wernicke Company for their Cincinnati plant, one 200-kilowatt belted generator and fifteen motors, in sizes of 5 to 30 horse-power, aggregating 380 horse-power in motors; for the same company at their Norwood plant, one 200-kilowatt engine-type direct-connected generator and twelve motors of 5 to 65 horse-power capacity, aggregating 530 horse-power in motors; the Armour Packing Company for their New Orleans plant, one 75-kilowatt engine-type direct-connected generator; the Water Works & Electric Light Company, Norwood, Ohio, two 100-kilowatt engine-type direct-connected generators; the Kenmare Dry Coal Company, Minneapolis, Minn., one 80-kilowatt belted generator; E. H. Hewins, Boston, Mass., two 30-kilowatt engine-type direct-connected generators; the Gardner Electric Light & Power Company, Gardner, Mass., one 50-kilowatt engine-type direct-connected generator; P. Derby & Co., Gardner, Mass., one 25-kilowatt engine-type direct-connected generator; the John A. Dunn Company, Gardner, Mass., one 30-kilowatt belted generator; Ralph S. Hopkins, Seattle, Wash., one 50-kilowatt belted generator; Northern Pacific Railway Company in their St. Paul shops, one 50-kilowatt engine-type direct-connected generator, and one 15 horse-power, one 7½ horse-power and one 10 horse-power motors; the Calvert Lithographing Company, Detroit, Mich. one 75-kilowatt engine-type direct-connected generator; the Beals & Selkirk Company, Detroit, Mich., one 30-kilowatt direct-connected generator; the Grady Union Stock Yards Company, Atlanta, Ga., one 30-kilowatt engine-type direct-connected generator; the Alexion Hospital, St. Louis, Mo., one 50-kilowatt engine-type direct-connected generator; the Eclipse Electric Company, St. Louis, Mo., one 25-kilowatt engine-type direct-connected generator; the James H. Curran Elevator Company, Cincinnati, twenty-one elevator motors; F. Woodlar & Co., Cleveland, Ohio, one 25-kilowatt belted generator; W. P. Callahan & Co., Dayton, Ohio, fifteen lighting machines, of 7½ to 10-kilowatt capacity; the Buckeye Iron & Brass Works, Dayton, Ohio, twelve machines, of 7½, 10 and 12½ kilowatts capacity; the Charter Oak Stove & Range Company, St. Louis, Mo., one 100-kilowatt engine-type direct-connected generator, and two 35 horse-power, one 25 horse-power, two 10 horse-power and two 5 horse-power motors.

In the near future the spectacle of a British steam railway operated by American electrical machinery will be a reality. The last of the main generators and engines intended to be installed in the power plant of the Mersey Tunnel Railway are about to be shipped from the Westinghouse works at East Pittsburgh. These generators are of the railway type (1,200 kilowatts, 650 volts, 90 revolutions per minute) and are to be direct connected to vertical cross-compound Westinghouse Corliss engines of 1,500 horse-power each. The power-house lighting and the electric light of all stations, sidings, etc., will be supplied from a separate generating plant, comprising two compound-wound generators, each having a capacity of 200 kilowatts at 650 volts, direct connected to Westinghouse compound engines and running at a speed of 250 revolutions per minute. The power-generating plant will have an aggregate output of about 6,600 horse-power—6,000 horse-power for the railway proper, and 600 horse-power for lighting. The Westinghouse electro-pneumatic system of train control is to be used and the cars will be equipped with Westinghouse high-speed air brakes. The rolling stock will consist of 60 cars, each about 60 feet in length. The trains will be formed of 5 cars each, the first and last cars of a train being motor cars equipped with four 100 horse-power motors each.

The Mersey Railway connects Liverpool and Birkenhead, and passes under the River Mersey. The tunnel is double tracked. The route of the railway is about four miles and a half long, the total length of track, including sidings, being about twelve miles long. Its situation is unique, joining two such important business cities between which the only competition in the transportation of passengers and freight is given by ferryboats on the river, and the traffic on the line is large. The number of passengers carried amounted to between seven and eight millions per year, even with the old steam locomotive system. It is expected that the trains will run on a three-minute service. The tunnel and the seven stations of the system are to be electrically lighted throughout. The power-generating station, the machinery and the track work are all being pushed rapidly to completion.

CHICAGO MACHINERY MARKET.

One maker of high-grade boilers says he is not only rushed with orders, but that he is employing the services of other boiler makers to the greatest possible extent to help him out in filling his obligations. The call for extraneous help may not be common, but the general report from the boiler factories is that the condition of order books is excellent and that they are not gaining upon the accumulated work. Engine builders make an even better statement of business. They are commonly turning down business, especially the makers of Corliss engines, each of about a half dozen Chicago representatives making that statement of affairs.

It is reported here that the Lackawanna Steel Company, of Stony Point, N. Y., has ordered twenty-two gas engines of 2,000 horse-power each, an aggregate of 44,000 horse-power, a first order for six of these engines being supplemented by another order for sixteen. There are said to be only two manufacturers in the United States making gas engines above 200 horse-power, though a year ago there were fourteen in Europe. At the Stony Point plant, for the fuel of these engines the gas from the iron furnaces and also from the coke ovens will be utilized. There are inquiries in the Chicago district for two 1,000 horse-power gas engines and negotiations are now in progress.

The iron and steel works continue good buyers of power. Within the past several weeks the Iroquois Iron Company, Chicago, and the Sloss-Sheffield Iron & Steel Company, Birmingham, Ala., have each bought two large blowers from the Allis-Chalmers Company. Other recent sales by the last-named company include two engines of 500 and 600 horse-power, respectively, to the Indiana Rolling Mill Company, Newcastle, Ind.; one 500 horse-power engine to the Detroit Copper & Brass Company; one 600 horse-power engine to the Brunswick-Balke-Collender Company, Chicago; one 500 vertical compound engine to the McCormick Harvesting Machine Company; one 500 horse-power engine to the city of Henderson, Ky., and engines to the Calumet & Arizona Mining Company, the National Lead Company, New York; Armour Institute of Technology, Chicago; Interurban Railway Construction Company, Ottumwa, Iowa; Hillard Milling Company, Milwaukee, and others.

Granville Kimball reports a larger inquiry for Scotch marine and horizontal tubular boilers than he can fill.

In general there has been less business actually placed in power during the past month than in the preceding two or three months, but the prospects for heavier sales are bright.

Quotations.

NEW YORK, Monday, August 25.

New York prices for Northern and Southern irons, largely nominal, are as follows:

Northern:	
No. 1 X	$23 50 @ $25 00
No. 2 X	22 75 @ 23 50
No. 2 plain	22 25 @ 22 50
Southern:	
No. 1 Foundry	22 00 @ 23 00
No. 2 Foundry	21 75 @ 22 50
No. 3 Foundry	21 25 @ 22 75
No. 4 Foundry	20 25 @ 21 25

Bar Iron—Base Sizes—Refined brands, mill price on dock, 1.93c. upward in car-

load lots. Smaller quantities from store, 2.15 @ 2.20c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel — Base sizes — From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 11½ @ 11¾c.; electrolytic and casting, 11⅜ @ 11½c.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, 28 @ 28¼c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots

Spelter—5⅜ @ 5½c.

Antimony — Cookson's, 10c.; Hallett's and U. S., 7¾ @ 8c.

Lard Oil—Prime City, 80 @ 85c., according to brand and quantity ranging from one barrel up to large lots.

New Catalogs.

Chas. Mundt & Sons, 88-90 Walker street, New York. 3½x6, pp. 45, paper.

Massachusetts Tool Co., Greenfield, Mass. Precision tools. 4x6, pp. 62, paper.

Jeffrey Manufacturing Company, Columbus, Ohio. Water elevators. 4x8, pp. 12, paper.

Gould & Eberhardt, Newark, N. J. Automatic tapping machine. 3½x6, pp. 8, paper.

Rochester Die Shaper Company, Rochester, N. Y. Vertical slotting attachment. Circular.

Cochrane-Bly Machine Works, Rochester, N. Y. The Rochester filing machine. Circular, 6x9.

The Herron & Bury Manufacturing Company, Erie, Pa. Air compressors. 3½x6, pp. 12, paper.

Buffalo Forge Company, Buffalo, N. Y. Buffalo improved ventilator. 3½x6½, pp. 15, paper.

The Morse Chain Co., Trumansburg, N. Y. Silent running high-speed chains. 6x9, pp. 19, paper.

The Baldwin Locomotive Works, Philadelphia, Pa. Rear truck locomotives. 6x9, pp. 17, paper.

The L. S. Starrett Co., Athol, Mass. New tools, supplement to Catalog No. 16. 7½x5¼, paper.

Wells Bros. Company, Greenfield, Mass. Screw-cutting tools and machinery. 4½x6, pp. 119, paper.

Moffett Vehicle Bearing Company, Saginaw, Mich. Moffett anti-friction roller bearings. 5x7, pp. 63, paper.

Manufacturers.

An electric light plant will be erected at Annville, Pa.

The J. B. Thomas Company, wool, Peabody, Mass., is about to build a new factory.

The factory of the Climax Buggy Company, Columbus, O., has been partially burned.

The Munising Paper & Pulp Mill Company is about to erect mills at Munising, Mich.

The New York Central Railroad is to build a new machine shop at West Albany, N. Y.

The saw and planing mill of S. R. Horner, Sebree, Ky., has been burned, but may be rebuilt.

Wm. Clore's Sons, Rising Sun, Ind., plows, etc., have been obtaining lumber for a new factory.

The Attawaugan Company, cotton goods, Ballouville, Conn., is building an addition for a machine shop.

The Tindel-Morris Company, manufacturer of steel forgings, etc., Eddystone, Pa., will build a forge there.

The Richmond Cotton Gin Company, of Chattanooga, Tenn., will erect a gin and compress at Huntsville, Ala.

The Wolverine Brass Works, manufacturers of plumbers' supplies, Grand Rapids, Mich., will erect a foundry building.

The Illinois Central is about breaking ground in South Memphis for the erection of large machine and car shops.

Pawling & Harnischfeger, crane builders, Milwaukee, Wis., have made plans for a foundry and machine shop addition.

The Michigan Steel Boat Company, Detroit, Mich., is about to put up an additional building, 80x600 feet, three stories.

The Briscoe Manufacturing Company, galvanized and sheet metal works, Detroit, Mich., has taken out a shop building permit.

It is reported from Spencer, Mass., that the lumber for an annealing mill to be built by the Spencer Wire Company has arrived.

The Norton Electrical Instrument Company, Manchester, Conn., has let the contract for the erection of a new factory building.

The Buffalo (N. Y.) Weaving Company, manufacturer of webs, halters and surcingles, is about erecting a new factory building.

A contract has been let to erect a new factory building at Howard street and Girard avenue, Philadelphia, Pa., for W. H. Horn.

The Russell & Erwin Manufacturing Company, hardware, New Britain, Conn., is to erect an addition, 175x50 feet, seven stories.

Wm. H. Ashley, of the Ashley & Shaw Silk Company, Hackettstown, N. J., has contracted for another silk mill to be built in Scranton, Pa.

Contracts have been let for a machine shop, 50x150 feet, to be built in Chicago for the Western Foundry Company, at a cost of $12,000.

The contract has been awarded for erecting an addition to the factory of the John Morrow Machine Screw Company, Ltd., Ingersoll, Ont.

Plans are made for the enlargement of the plant of the Codorus Paper Company, York, Pa. It manufactures roofing and lining papers.

The David Maydole Hammer Company, Norwich, N. Y., will erect a main mill and office building, a grinding room and a tempering room.

The Park City Manufacturing Company, of Chicago, manufacturer of crank hangers, will remove its plant to Webster City, Ia., next season.

Plans have been made for the further enlargement of the Dewees Wood plant of the American Sheet Steel Company, at McKeesport, Pa.

Paterson silk mill owners think of establishing a branch plant at Oxford, N. J. Michael Sweeney, of Oxford, is in touch with the project.

The Stanley Electric Manufacturing Company, Pittsfield, Mass., has awarded the contract for a building, 195x70 feet, with a wing 350x56 feet.

The Valley Iron Company, which will build several furnaces in the Chattanooga, Tenn., section, had the date of its organization set for August 27.

A new manufacturing building, 120x180 feet, will be put up for the Berg Company, Philadelphia, Pa., for the manufacture of fertilizing materials.

The Minneapolis (Minn.) Threshing Machine Company has let a contract for the erection of a new boiler shop (150x275 feet) and foundry addition.

A boiler-house, 33x30 feet, is about to be built for the Rawson Manufacturing Company, manufacturer of step ladders, bed springs, etc., Philadelphia, Pa.

The General Electric Company has been laying out the ground of its River Works, at Lynn, Mass., with plants, shrubs and seats for the benefit of its employees.

The Pennsylvania Railroad Company has awarded the contract for piling for the foundations for its new roundhouse and shops at Todd's Cut, near Edge Moor, Del.

The Harlan & Hollingsworth shipbuilding plant, Wilmington, Del., has been transferred to the United States Shipbuilding Company. The price is said to be $1,500,000.

The Hamilton Steel & Iron Company, Ltd., Hamilton, Ont., has decided to expend about $200,000 on enlarging the steel plant and increasing the blast furnace capacity.

At the air compressor works in Franklin, Pa., of the Chicago Pneumatic Tool Company, a frame building is being erected, connecting the machine shop with the foundry.

Improvements are to be made at the plant of the Topeka (Kan.) Steam Boiler Works (Joseph Bromich, proprietor). The new plant will be provided with electric power.

The Bay City (Mich.) Knitting Company has just purchased mill property, and an addition will be built to it, to be used as a boiler-room and finishing department.

It is reported from Syracuse, N. Y., that Lyman C. Smith is erecting in Hudson, at a cost of about $400,000, a plant where he will make Portland cement by a new process.

A Pittsburgh building permit has been issued to the American Foundry & Construction Company for a foundry building at Kansas and Twenty-third streets, to cost $10,000.

The Wray, Austin Machinery Company, Detroit, Mich., is beginning to erect a new wood pulley factory, including main building, 160x50 feet, with dry kiln and boiler-house.

The Landers, Frary & Clark Company, hardware, New Britain, Conn., has obtained a permit to erect a factory building, 130x40 feet, which will be used for a grinding department.

A contract has been let by the Yoakum Improvement Company for a steel plant to be erected in Yoakum, Tex. The main building will be 50x104 feet, with an annex 50x80 feet.

The Electrical Equipment Company, Reading, Pa. (W. D. Jones and George A. Rick, proprietors) intends erecting a plant for repairing dynamos and other big electrical apparatus.

The American Can Company is said to have plans for the first building—200 feet square—of a plant at Joliet, Ill., and to be contemplating the erection of another plant at East Rome, N. Y.

A power plant is to be built by the Intervale Traction Company, along Moodna Creek, in the town of Cornwall, N. Y. Surveys have been under way by Civil Engineer V. K. Mills, of Goshen, N. Y.

McCormick & Co., manufacturing chemists, Baltimore, Md., have bought a building containing soap-making machinery, crude and refined glycerin plant, etc., but new machinery will be installed.

The Council of Madison, Ind., has adopted a resolution accepting the proposition of the Arm Bracket & Pin Company, of Jamestown, Ind., to locate for $2,500 bonus, the company to employ thirty to fifty men.

The Baldwin Locomotive Works, Philadelphia, Pa., among other improvements that

they are making, will build a new finishing and shipping department with a photograph gallery, including a turntable.

It is apparent, from the figures furnished in the last report of the Lowell, Mass., Water Board, that the pumping plant at the West Sixth street station will, at an early date, need to be extensively renewed.

The Hunter Arms Company, Fulton, N. Y., manufacturer of shot guns, is enlarging its plant. The increasing business of both this company and the Hunter Fan & Motor Company has made these extensions necessary.

It is reported from Denver, Colo., that the Great Western Beet Sugar Company will build a sugar factory at Windsor, Colo. Charles Boettcher is president of the company, which has a plant at Loveland, Colo.

Plans have been made for an addition to a factory for Frank S. Betz & Co., manufacturers of folding vapor baths, Chicago, Ill., the improvements to cost about $100,000. The new part is to be three stories, 100x400 feet.

C. H. Halcomb, formerly connected with the Crucible Steel Company of America, is said to be in England interesting Sheffield capitalists in an enterprise which will produce machinery and tool steel in the Pittsburgh district.

Geo. B. Bassett, Buffalo, N. Y., will erect a factory for gas and water meters of brass. The building will cost $20,000 and will be equipped with modern appliances. The contract calls for its completion by March 1, 1903.

The Twin City Rapid Transit Company, Minneapolis, Minn., is to invest over $1,500,000 for a new power plant, etc. Sargent & Lundy, expert civil engineers, of Chicago, have been in the city looking for a site for the plant.

Work is progressing on the plant of the Knoxville (Tenn.) Iron Company at Lonsdale. The improvements will cost $500,000. It is the intention of the company to add a steel plant in a short time which will cost $500,000 more.

It is reported that the Adhesive Gimp Company, 405 East Ninety-first street, New York city, has purchased property for a plant at Valatie, N. Y. The gimp is woven on Jacquard silk looms, and silk spinning will be another feature.

There is an unconfirmed rumor that the United States Shipbuilding Company will erect at Newport News a steel plant to employ at the start 1,000 men, for the purpose of supplying the companies of the organization with steel.

Improvements and additions to cost upwards of $50,000 are to be made to the plant of the Detroit (Mich.) Shipbuilding Company, the largest being a new foundry. The most modern machinery will be installed, including electric cranes.

The Springfield Separator Company is starting a new plant at Manchester, N. H., and equipping it with modern tools. It will make, in addition to its line of separators, various machine tools, with a specialty of experimental and turret lathe work.

The Maryland Paper Company, Cumberland, Md., has decided to double the output of its plant by the installation of machinery to cost $80,000, and give employment to 100 more men. The company manufactures manillas and high-grade fiber papers.

The United Shoe Machinery Company, Boston, Mass., was lately reported to have decided to locate its plant at Beverly. The company proposes, it is said, to consolidate all its manufacturing plants. It has since been denied that the location is yet determined upon.

Ellsworth, Me., on Union River, is expecting a great industrial boom in the coming year. An electric railway from Ellsworth to Castine, to cost $500,000; the development of the water power of Union River at an expense of $300,000, and the establishment of a wood-working plant to employ 400 hands are among the enterprises proposed and said to be assured.

It is reported from Wapakoneta, O., that a company organized at Cridersville, O., for the manufacture of electrical novelties and for furnishing an electric light plant at that village, has been succeeded by the Bloom-Kloeb Company, which has entered into a contract with the Board of Trade and arranged to begin work on the factory within a short time.

The Capewell Horse Nail Company, Hartford, Conn., is having a 350x150-foot, three-story building erected. It will get power from its old power-house, which was not damaged by the fire. The building is being put up by the Berlin Construction Company, which has so much work on hand that it is contemplating enlarging its own plant at Berlin, Conn.

The Emmert Manufacturing Company, Waynesboro, Pa., which recently added a shop which was blown down by a storm early in July and has been rebuilt, is having to put up still another, the demand for its vises is increasing so rapidly. Recently the company began to make a machinists' vise for handling metals, in addition to its universal wood-workers' vise. Also there has been made and patented a jewelers' vise.

The Columbia Steel Company has advertised for bids for the erection of its buildings at Elyria, O. The plans call for a main building, 400x800 feet, and other buildings for shipping and store room, engine and boiler houses. The product is to be cold-rolled steel sheets, such as are used in typewriters, sewing machines, telephone fixtures and hardware specialties. Walter P. Rice, of Cleveland, is the engineer, and J. C. Smith, of Elyria, is the manager.

Announcement is made of the immediate building of a factory to manufacture white metal at Sault Ste. Marie. The power company has provided a site at the east end of the American Soo, and has contracted to deliver 1,500 horse-power, 800 to be delivered by December 1. Nickel for the plant will be supplied by the Clergue mines, at Sudbury, Ont. The company is composed of Eastern men not previously identified with the Clergue interests in the two Soos.

The reorganized Empire State Power Company has awarded to Henry W. Grieme and B. E. Machold, of Amsterdam, N. Y., the contract for making extensive repairs to the power plant at Schoharie Falls. This, with other improvements, will permit the company to supply approximately 4,000 horse-power. A large portion will be used by the Helderberg Cement Company's works, at How's Cave. Next year the power company will erect another power plant at Mill Point or Burtonville and a storage reservoir in the Helderbergs.

President D. W. Curry called a meeting of the Rome (Ga.) Board of Trade recently to consider the establishment of a plant for the manufacture of freight cars. It was resolved to build the works and to this end committees were appointed as follows: C. E. Goetchius and H. D. Hill, to select a site; Berry Randall, Robert Graves and Will West, to solicit subscription to stock. The company proposes to start with $50,000 capital stock. It will require 25 acres for the plant. It will be conducted on the co-operative plan, and each workman in the shops will have a direct interest in it.

The Keeler Pipe Manufacturing Company, of Pittsburgh, Pa., has purchased land near Portsmouth, N. H., and the plant of the New England branch will be establish there. The company has placed a contract with W. C. Edwards, of Boston, architect and builder, for the erection of a main building 170 feet long, which will be filled with heavy machinery for the manufacture of pipe iron plate and structural iron work. A foundry building will also be necessary. The plant will employ 150 skilled iron workers. The Keeler Company has the contract to furnish all the pipe to be used by the White Mountain Paper Company in bringing its water supply to Portsmouth from South Berwick, and it will take about a year and a half's steady work to complete the contract.

A report emanates from Allentown, Pa., that King Alfonso of Spain is interested in the Cristina Company, which is said to be about to establish a brick-making plant near Madrid, with a daily output of 1,200,000 bricks, the plant to be entirely equipped with American machinery, at a cost of nearly $600,000. The company, it is understood, is also to build an American Portland cement plant in the vicinity of Barcelona. This factory will be operated by a hydraulic plant of 2,000 horse-power, which will also be constructed with American equipment. Pennsylvania mills will turn out some 1,500 tons of pipe for the hydraulic plant. Wm. Jennings, of Nazareth, Pa., has left for Spain to superintend the erection of the cement plant. Louis B. Saeger, son of Chas. M. Saeger, has sailed to become the company's assistant general manager and chemist.

There has been organized in Toledo, Ohio, the Libbe Engineering and Construction Company, with a capital stock of $300,000. The directors include Walter S. Powers, of Battle Creek, Mich., and J. H. W. Libbe, Thomas J. Birney and M. J. Gavin, of Toledo. Mr. Libbe was elected president and M. J. Gavin secretary. The company will make a specialty of sewer and trench machines, but will be equipped with machines for all kinds of constructive work, including sewers, water and gas trenches, open ditches, irrigating and ship canals. Mr. Libbe is the inventor and patentee of the trench machine, and has been working on it for years. The company will build a small plant at first on Mr. Libbe's property, but it is the intention to add to it as soon as the first machines have been put out. They will cost about $1,000 each, and are made almost entirely of structural iron.

In spite of a shortage of about 150 men, work on the big foundry and pattern shop of the Allis-Chalmers Company, at West Allis, Wis., is being rushed to a finish. All the tracks and turntables in the foundry are completed, and some large cranes have been put in place. The 500 horse-power engine and boilers are understood to have been started by this time. There are said to be 700 men engaged in construction work on and about the structure. The foundry is being enlarged from the original plans even before it is completed. An extension to the north, 212 feet long, will be added, making the total length 778 feet, the width of 220 feet to be continued throughout. Chief Engineer Edwin Reynolds, however, provided for this contingency in his plans, by which the plant is so arranged that any one of the main buildings, machine shop, foundry and pattern shop, can be enlarged without interfering with work.

The consolidation of the Union Railway Power & Electric Company, the Morris Electric Company, Fountain Manufacturing Company and five other established railway equipment and electrical companies under the name of the American Union Electric Company, with a capital of $7,000,000, of which $5,000,000 is outstanding, will, it is said, do away to a large extent with the middleman's profits. The company, which has an extensive plant at East Orange, N. J., is building a large

addition. The business consists in the manufacture of rail bonds, trolley wheels, fare registers, trucks and sweepers, headlights, car trimmings, and electric devices such as panel boards, switches and switch-boards, junction boxes, etc., and brass castings. The management of the company is under the direction of Elmer Morris, S. M. Young, E. P. Ewing and J. Fountain, with the New York headquarters at 15 Cortlandt street. The company is running overtime to fill its orders.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant: see p. 18.

Punches & Dies. Wal.M..ks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Will estimate on small machinery or specialty. Box 232, Clifton, Pa.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

For Sale—2 H.-P. gas or gasoline engine; price $40. P. O. Box 1171, Springfield, Mass.

Metal bench drawer hangers, better'n wood. American Art Agency, 127 So. Green st., Chicago.

Book, "Dies and Diemaking," 100 6x9 pages, $1, post paid; send for index. J. L. Lucas, Bridgeport, Conn.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Purchaser for an established manufacturing business, including patterns and tools; it is suitable for any first-class machine shop. Address No. 20, care AMERICAN MACHINIST.

Gear and milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears, catalog of small tools free. R. M. Clough, Tolland, Ct.

Wanted—Some reliable manufacturer wanted to make and place on the market, on royalty, the "Ermo" pipe wrench as described in AMERICAN MACHINIST, on page 1237.

Grinding beats filing; try us, on either hardened or soft work; capacity 7 in. diameter, 48 in. long and under. The Garvin Machine Co., Spring & Varick sts., New York City.

Purchaser for small manufacturing plant in Madison, Wis.: lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

Owing to the death of one of the active members of a machine and foundry business (incorporated for $100,000) the present management wish to find a man with a thorough knowledge of the business, that would take hold with energy and invest some capital; this is a rare opportunity for the right man; paper and pulp mill machinery a specialty. Address M. & F., care AMER. MACHINIST.

For Sale—Half interest or entire plant, consisting of machine shop, foundry, pattern shop, large stock of patterns and boiler shop, in one of the largest Southern cities; well equipped for every class of work and now engaged on a large amount of profitable contract, repair and special work; location near center of city on main lines of several railroads; climate perfect. Address Box 755, AMERICAN MACHINIST.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Draftsman wishes position by middle of September; New York or vicinity. Box 773, A. M.

Draftsman with practical machine shop experience desires position. Box 805, AM. M.

As first-class patternmaker, with foremanship in view; good references. K. G., care AMERICAN MACHINIST.

Light hardware and machinery designer, experienced superintendent and cost saver. Box 810, AMERICAN MACHINIST.

Position as foreman or superintendent, by an all-around machinist, toolmaker and designer. Box 811, AMERICAN MACHINIST.

Mechanical draftsman, with shop experience, wants work on light designing or general detail work. Box 806, AMER. MACH.

First-class mechanical draftsman, graduate, hard worker, desires position; hoisting machinery preferred. Box 820, AMER. MACH.

Situation as superintendent or foreman of machine shop, by man of 24 years' varied experience, 12 in charge. Box 776, AM. MACH.

Draftsman, large experience in oil engines and experimental work, is also patent attorney, is open for engagement. Box 801, A. M.

Wanted—Position as superintendent of plant or foreman of machine shop, by man of extended experience; references on request. Address C. E. Tower, South Bend, Ind.

Position wanted as erector, on engines, boilers, power plants, etc., by mechanic with drawing-room, shop and sea experience; first-class references. Address Box 813, AM. M.

Wanted—Position as foreman of machine shop; small, growing one or one just starting in business preferred; prefer Indiana, Illinois or Kentucky. Box 802, AMER. MACHINIST.

Experienced machine designer, practical, thorough, original, 10 years on automatic machinery, graduate, wants position of responsibility in or out of drafting room. Box 817, AMERICAN MACHINIST.

Superintendent and designer, 36 years, original ideas and thoroughly familiar with shop practice, drawing-room and office work, wants position; gas or oil engines preferred. Box 815, AMERICAN MACHINIST.

Practical and technical engineer, speaking both French and Spanish, with thorough knowledge of foreign machine tool trade, wishes position; vicinity of New York preferred. Answer E. A. J., care AMER. MACH.

Mechanical engineer, Swiss, 28 years old, with large, practical experience in drawing-room and job work, desires permanent position in growing firm; can furnish best of reference from reliable firm of Europe. Box 800, AMERICAN MACHINIST.

Mechanical engineer and draftsman wishes to change in September; technical education; large experience as foreman, master mechanic and superintendent manufacturing small and medium interchangeable machinery and fine steel instruments. Box 712, AMER. MACH.

A practical machinist of experience in the shop on different classes of work and tools and outside erecting work is open for an engagement and prefers outside erecting work; can furnish the best of reference as to character and ability. Box 814, AMER. MACH.

Assistant foundry foreman desires position as foreman in a shop employing about 20 men, or assistant in a larger shop; thoroughly practical on machinery, valves, etc.; also a thorough knowledge of molding machines; good recommendations. Address No. 77, care AMERICAN MACHINIST.

Practical mechanic of 35 wants position as foreman or assistant to manager; have held same in the past; would like to hear from parties wanting a man for a responsible position on medium or light machinery, such as line-casting or type-casting machine, typewriters, cash registers, or any like lines; can refer parties to past and present employers; at liberty September 1. Box 821, AM. M.

Advertiser, at present in the boiler business, formerly general foreman of works building large engines, and who is a "sharp" on the subject of modern water tube boilers, stokers and engines, wants position with reputable engineering firm or with concern contemplating improvements in power equipment; am 30 years old and married; wish to leave the road; A1 references. Box 816, A. M.

Help Wanted.

Wanted—First-class machine designer. Address, with reference, Box 812, AMER. MACH.

Wanted—Draftsman, experienced on punching and shearing machinery. Apply, stating age, salary, Box 796, AMER. MACHINIST.

Mechanical and structural draftsmen; experienced technical graduates preferred. Box 71, Station B, Cleveland, Ohio.

Wanted—A first-class wood pattern maker; ten hours day; wages 30c. per hour. Address Wm. E. Hill & Co., Kalamazoo, Mich.

Good salesman to sell gas engines; either salary or commission to the right man; give age, experience and terms. Box 766, AM. M.

Wanted—An experienced foreman for milling department on light work; reference required. The Blinkensderfer Mfg. Co., Stamford, Conn.

Wanted—First-class machinist floor hands, lathe and plane operators; steady work and good wages for industrious men. Box 809, AMERICAN MACHINIST.

Wanted—A young machinist with experience in engine building and testing; good opportunity to advance. Address American Blower Co., Detroit, Mich.

Wanted—Several A1 draftsmen; give experience, reference and salary expected. Engineer in Charge, Drafting Department, General Electric Co., Schenectady, N. Y.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—Foreman for erecting department; a man experienced in engine work desired; none but a hustler need apply; state wages expected and give references. Box 808, A. M.

Wanted—First-class machinists experienced on compressor or engine work; steady employment for good men. Chicago Pneumatic Tool Company, Franklin Air Compressor Works, Franklin, Pa.

Three draftsmen at once to work on Willans central valve engines; must be familiar with metric system. Apply giving experience, references and salary, to Bradley Mfg. Co., Pittsburgh, Pa.

Wanted—A first-class draftsman and designer with experience on pumps and pumping machinery; state experience in detail, references and salary expected. Box 794, AMERICAN MACHINIST.

Wanted—Machine shop foreman for general machine work; a young Western man preferred; must be energetic; shop working 25 or 30 men. Address, stating wages expected and references, Box 797, AMER. MACHINIST.

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Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Crocker-Wheeler Electric Co., Ampere, N. J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrically-Driven Tools.
Clark, Jr., & Co., Jas., Louisville, Ky.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Backus Water Motor Co., Newark, N. J.
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Struthers, Wells & Co., Warren, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Eye Shield
McDougal, W. H., Charleston, W. Va.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.
Troy File Works, Troy, N. Y.

Filing Machines
Cochrane-Bly Mach. Co., Rochester, N. Y.
Rotary File & Mach. Co., Brooklyn, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wk., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Chicago Pattern Works, Chicago, Ill.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
N. Y. Gear Works, Brooklyn, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Modern Tool Co., Erie, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Safety Emery Wheel Co., Springfield, Ohio.
Tanite Co., Stroudsburg, Pa.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Tanite Co., Stroudsburg, Pa.

Grindstones
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co., Mfg. Co., St. Louis, Mo.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sprague Electric Co., New York.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Chattanooga Mchry Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Harris & Co., Saml., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathe Feed
National Mach. & Tool Co., Cincinnati, O.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Co., Wm., Cincin., O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fairbanks Machine Tool Co., Springfield O.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Tanite Co., Stroudsburg, Pa.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Gardam & Son, Wm., New York.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Prov., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Prentiss Tool & Supply Co., New York.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Straley, Hasbrouck & Schloeder, New York.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Prentiss Tool & Supply Co., New York.

Patterns, Wood
Gobeille Pattern Co., Cleveland, O.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
American Tool Wks. Co., Cin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Presses, Hand
Elmes Engr. Works, Chas. F., Chicago, Ill.

Presses, Hydraulic
Bement, Miles & Co., New York.
Elmes Engr. Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Prentiss Tool & Supply Co., New York.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Elmes Engr. Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting,
Cooke Machinery Co., New York.
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
State College of Kentucky, Lexington, Ky.
Purdue University, Lafayette, Ind.
Worcester Polytechnic Institute, Worcester, Mass.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.
York Mchry. Co., S. M., Cleveland, O.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Barker & Co., Wm., Cincin., O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Smith & Mills, Cincinnati, O.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Phila., Pa.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Sprocket Chains
See Driving Chains.

Stampings, Sheet Steel
Federal Mfg. Co., Cleveland, O.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Steel, Machinery
Hermann Boker & Co., New York.
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Federal Mfg. Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Hermann Boker & Co., New York.
International Steel & Mach. Co., New York.
Patriarche & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Mach. Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Foster, Walter H., New York.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Unions, Brass
Nolte Brass Co., Springfield, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Hollands Mfg. Co., Erie, Pa.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Howard Iron Wks., Buffalo, N. Y.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.